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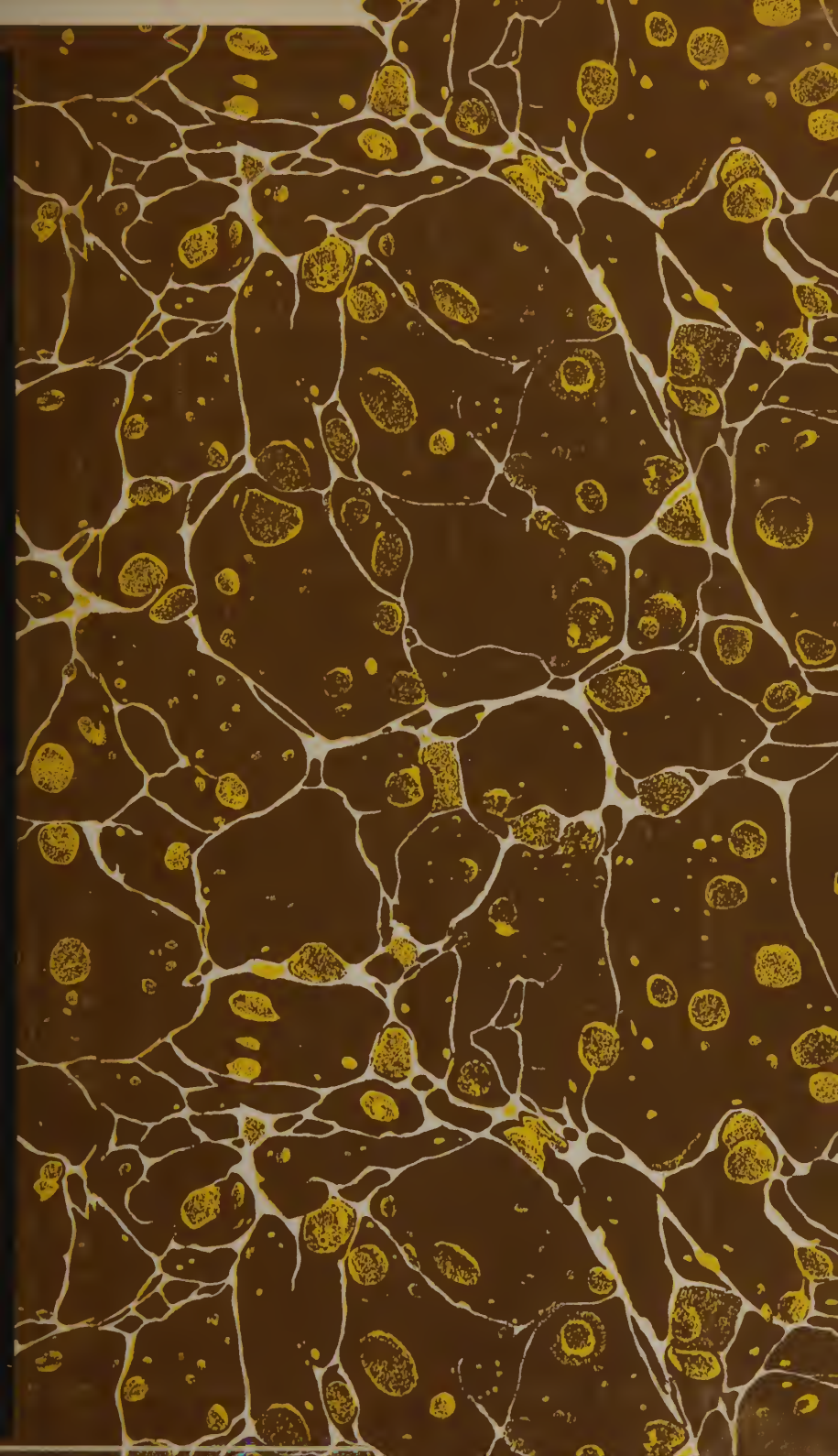
ANNALS

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NEW ELEMENTS OF OPERATIVE SURGERY:

BY

ALF. A. L. M. VELPEAU,

Professor of Surgical Clinique of the Faculty of Medicine of Paris, Surgeon of the Hospital of La Charité,
Member of the Royal Academy of Medicine, of the Institute, &c.

CAREFULLY REVISED, ENTIRELY REMODELLED, AND AUGMENTED WITH

A TREATISE ON MINOR SURGERY.

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AN ATLAS IN QUARTO OF TWENTY-TWO PLATES.

REPRESENTING THE PRINCIPAL OPERATIVE PROCESSES, SURGICAL INSTRUMENTS, &c.

FIRST AMERICAN, FROM THE LAST PARIS EDITION.

TRANSLATED BY

P. S. TOWNSEND, M.D.

Late Physician to the Seamen's Retreat, Staten Island, New York.

AUGMENTED BY THE ADDITION OF

SEVERAL HUNDRED PAGES OF ENTIRELY NEW MATTER,

COMPRISING ALL THE LATEST IMPROVEMENTS AND DISCOVERIES IN SURGERY,
IN AMERICA AND EUROPE, UP TO THE PRESENT TIME.

UNDER THE SUPERVISION OF, AND WITH NOTES AND OBSERVATIONS BY

VALENTINE MOTT, M.D.

Professor of the Operations of Surgery with Surgical and Pathological Anatomy, in the University of
New York; Foreign Associate of the Académie Royale de Médecine de Paris,
of that of Berlin, Brussels, Athens, &c.

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P R E F A C E

BY P. S. TOWNSEND, M.D.

The SECOND VOLUME of this First American Edition of Velpeau's Operative Surgery, (from the last Paris Edition, 1839,) as translated, and with notes, by Dr. Mott and myself, has at length been completed, and is now offered to the Profession; one volume (the 3d) only remaining, which will be put to press on July 1st, ensuing, forming thus a work of 3000 large octavo pages, or an average of 1000 pages to each volume, including therein, with the Quarto Atlas, which will accompany the work, some 400 to 450 engravings of instruments, processes of minor surgery, and special operations. The entire *new matter* prepared for this edition, and 500 pages of which will be found in this second volume, will make, altogether, in the body of the work, some 1200 to 1500 pages, comprising in the same, as will be seen in this present volume, a distinct chapter of 100 pages, on the subject of ANEURISMS, LIGATURES UPON ARTERIES, &c., from the pen of Professor Mott, together with all his *capital operations*, viz.: for Aneurisms, Amputations, Exsections, &c., accompanied with plates; this new matter embracing also all the latest improvements and discoveries in Operative and Pathological Surgery, brought down to the present year, the whole under the immediate supervision of Dr. Mott.

It would be superfluous to dwell on the extreme, not to say often intense labor, required for the proper performance of this task by those who have undertaken it. It is gratifying to know, however, that in the midst of numerous and often pressing professional and other personal engagements, the book is now, at least, *two-thirds completed*. Notwithstanding the unavoidable and unanticipated obstacles which have necessarily and naturally at times interposed to retard the consummation of a labor of such magnitude, we, as well as the public, have now sufficient encouragement, derived from the favorable reception the first volume has already met with, the elegant and correct typographical execution which it has received from the co-operation of the publishers, printers, and engravers, and finally, the satisfaction which its outward costume, as well as intrinsic merits, have given to those who have translated, prepared and supervised its text; to consider, and to offer its progress so far, as a guarantee of its ultimate completion, and general adoption, and as the principal Elementary Text Book on Surgery, for all students and practitioners, at least, in America, if not in other parts of the world.

We confess that it is with pride we present this work to the Profession; not so much, perhaps, from any pretensions we might make, in respect to the exactness and fidelity of the translation, or the composition and substance of the vast amount of *new matter* superadded, as from the conscious conviction we feel that there can be found nowhere, in any language, a surgical work so thoroughly complete, and so judiciously classified in (as has already been said in the Prefaces to the First Volume) the abundant and highly interesting and invaluable details which it comprehends, of surgical processes and discoveries, and surgical anatomy and relations, traced down with astonishing erudition and acute discrimination, by the learned author, Professor Velpeau, from the earliest epochs to the present day.

Though our labor has been one of a mechanical kind, demanding untiring assiduity and industry, rather than any originality of mind or invention, we must be permitted to say, that, with the contributions which have been engrafted upon

this American Edition, and Translation, and which have been furnished as well by Professor Velpeau himself, (See Vol. I.,) as by Dr. Mott and the writer of this Preface; the student, especially, cannot fail to find herein an inexhaustible arsenal or armory, systematically arranged in every department, for almost everything he may desire, that is truly valuable or worthy of preservation, in the great and controlling domain (now monopolizing almost the entire healing art) of Practical, Operative, and Pathological and Anatomical Surgery. I would, furthermore remark, that however little of originality or genius, (speaking in reference to myself,) may be accorded by the world to my own opinions or views expressed in this work, credit at least will be given to the new facts which I have added, and which have been obtained at the cost of much time, and severe researches into and a close analysis of all that has been published in different parts of the earth, on matters appertaining directly to Surgery itself, strictly so called, or indirectly to this noble art, through the discoveries and investigations of sciences immediately collateral to it.

I do not wish nor intend to dwell upon my own part in this performance, as I make no special pretensions to Surgery, however much I may admire the commanding solidity of its structure, over that of any other branch of Medicine, or however ready I may have been to avail myself of all the occasions which have presented themselves in my professional career, of indulging in a practical application of its principles, at least, to many of its minor operations and elementary processes.

My professional labors have, it is true, been for the greater part of my life confined more to the practice of Medicine itself, strictly so called, and especially directed to the investigation of febrile diseases, as personally examined and investigated by me under all their varied aspects of climate and topography, and the influences of the latter on the human organization.* I shall, however, never cease to reflect with pleasure, hard as the task has been, in the thought that in what concerns the great department of *Practical Surgery*, I shall have left some testimonials, (lasting I trust) of my industry at least, and of my zeal to promote the advancement of an art whose high utility all the world, especially since its brilliant progress within 30 and even 10 years past, now concede to be open to palpable and actual demonstration, and as indisputably entitled to be ranked as an exact science, and as far beyond the reach and assaults of empiricism as mathematics itself.

Another source of extreme satisfaction to me will be in the reflection that the profession in after times, perhaps, may not be unwilling to bestow their commendation upon these efforts. But a still higher source of gratification I frankly confess, is that of the conviction, that in my attachment to a long-cherished, personal, and honored friend, preceptor and kinsman, and one whose eminent skill justly fills so large a space in Surgical history, (Dr. Mott,) I may have been, as I pledged myself I would be, (see Vol. I.,) instrumental both for him, and for his country, in rescuing the details of all his great and master operations, and discoveries, and improvements in surgical processes and principles, from that indistinctness into which they were necessarily passing, by his neglect, (culpable, it would be, but from his repugnance to self-laudation,) to gather them together as I now have done in these volumes, from the scattered Medical and Surgical periodicals and fugitive works, in which they had been briefly registered, successively as they emanated from his great practical mind, or were created into existence by his incomparable genius and consummate skill.

* I will refer here, to some of my principal writings on those subjects:

1. My *Report* on the *Fever* which prevailed in *Bancker Street*, New-York, in the Summer and Autumn of 1820.
2. Account of the *Yellow-Fever* of New-York, in 1822.
3. Account of the Weather, Topography, and Diseases of the Bahama Islands, West Indies, 1823-4-5, published at New-York, 1826.
4. Account of the Black Vomit, or *Yellow-Fever*, at Havana, Island of Cuba, West Indies, 1830.
5. Sundry Essays in various Medical Periodicals, &c.
6. My *Report* on the *Yellow Fever*, imported from the West Indies into Rondout, Ulster County, State of New-York, on the Hudson River, 100 miles North of New-York city, in the summer of 1843.

These master operations have been now, as will be seen, in Dr. Mott's own special chapter on *Aneurisms*, also that of *Exsections*, &c., completely arranged and revised under his own inspection, in chronological order, so that hereafter there may be an orthodox work, to which reference may constantly be made for the authentic evidence of what he lays claim to as a Surgeon, and which, thus now, for the first time published to the world, in their *ensemble*, and under his sanction, together with his last, and latest opinions on these matters, present, in our view, we must confess, a precious treasure, for the student for all future time. It will, we feel assured, prove to be a great *organum* in Practical Surgery which the practitioner, as well as student, may never cease to peruse, and to re-peruse, as embracing some of the most important general *axioms* both in the minute manipulations and in the higher order of Surgical operations, and which will long continue to be received from so exalted a source, as among the surest and most practical land marks to guide those who aspire to eminence in this science, in their onward march to success and honor.

I feel constrained also to add, that the accomplishment of this part of my labor, is one to which considerations of love of country add in my mind no slight degree of value. For young as our country is in history, and filled as its annals are with great names, both in the heroic period of its settlement, and in its subsequent ages of military renown, national emancipation, and diffusion of the arts, there is in my humble judgment no name that adorns those annals either in the battle field, or in the councils of government, or in its diplomacy, that has added more sterling reputation, and abiding lustre to the intrinsic glory and future fame of America than that of VALENTINE MOTT, unaided and ungilded though that name may be by the insignia of office or of power.

For one who in his duties as a christian and a man of science, has done so much personally in the active field of benevolence, and struck out such noble discoveries and new paths to enable us more effectually to alleviate the miseries of our fellow creatures, there will be a balm as we believe, that will rest upon his memory in after time, less dazzling perhaps, but certainly full as enduring, and far more endearing to future generations, than any that the most ardent homage of patriotism could feel inspired with, for the glare of the most brilliant civic or military exploits.

Thus much I have deemed it my duty here to record personally, at least of the views entertained by myself of the appreciation due to the accomplished Surgeon with whom I have had the honor to be associated in these labors.

And with these remarks I will not detain the reader longer than to say, that in this Volume will be found treated all the *great and master, or capital* operations in the highest branches of Surgical Science, and which once constituted almost its only domain, to wit, Diseases and Operations upon the *Arteries, Veins, and Nerves*, with *Amputations, Dislocations, and Fractures*, and the important and comparatively new department of *Exsections*. In the course of which, it will be perceived that I have (as in our first volume also,) taken especial care in this, to do impartial justice not only to European Surgeons, but also to those of my own country, who occupy an honorable rank in the Science, and have, therefore, in most instances, recorded at full length, the master operations the latter have performed, or the more important additions that have been contributed by them since M. Velpeau published his last edition. Thus have I given the labors of Barton, Ruschenberger, Buck, Carnochan, &c., a deservedly conspicuous place in these pages. I shall therefore, now proceed at once to the details of the SUPPLEMENTAL APPENDIX which follows this Preface, and which it has been found necessary to prepare, in order to embrace a brief notice at least of some of the more important points in Surgical processes and improvements, and Surgical Pathology and Anatomy, which have not been made public, or which were not accessible until after this volume had been put to press, or had advanced too far towards its completion, to allow of their being incorporated in their proper place in the body of the text, as they will be, and as will be also those of the first volume, in the next edition of this work.

P. S. T.

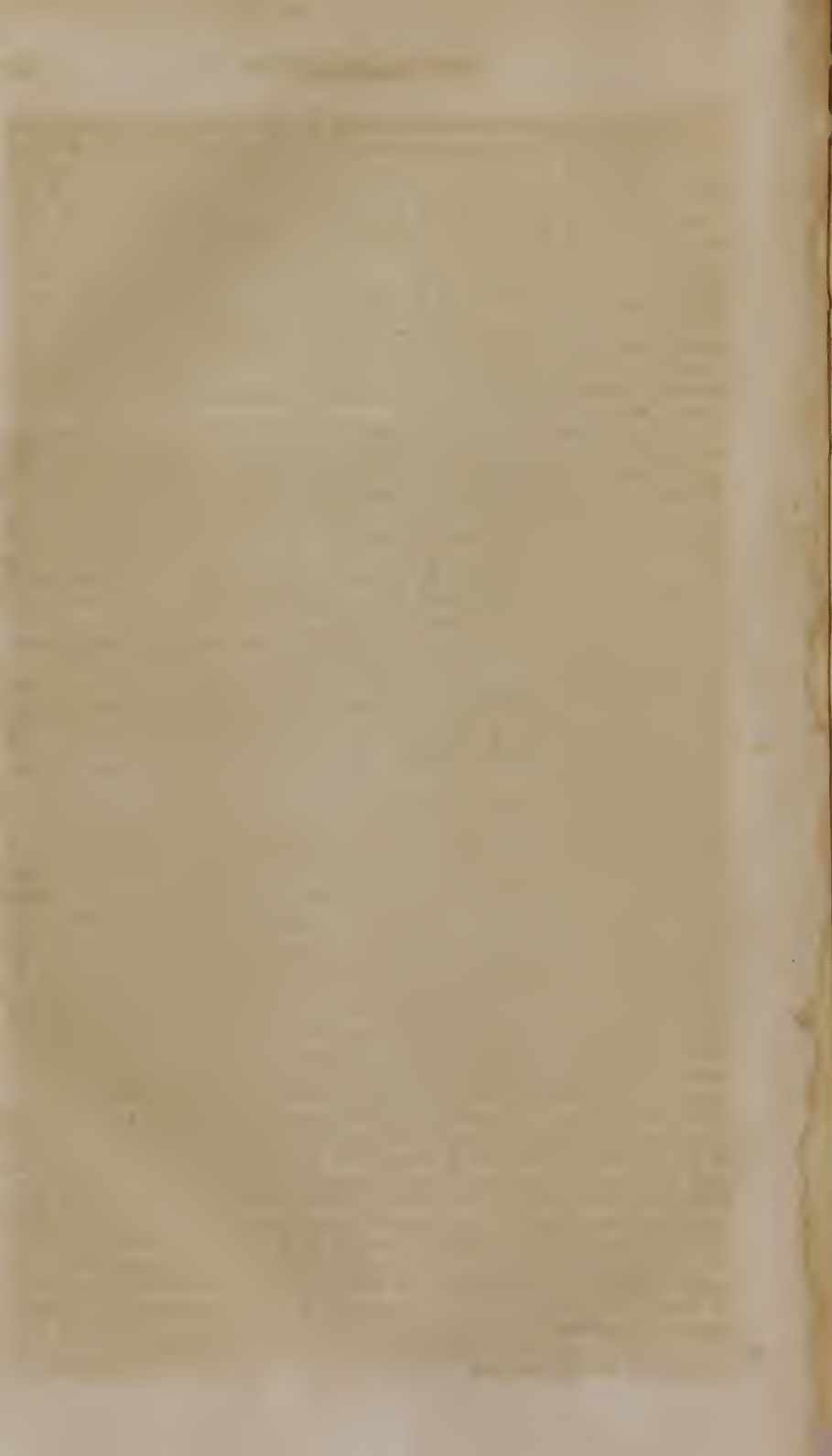


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SUPPLEMENTAL APPENDIX

TO THIS AMERICAN EDITION, VOL. II.

Plan to remove certain serious Objections to the Dextrine Bandage.—It is well known, from the melancholy results which attended the application of the dextrine bandage to the fractured arm in the case of Professor Dubovitsky of St. Petersburg, (vid. supra, Vol. I., text,) and from a still more disastrous result in a case of fracture in the practice of one of our most respected and eminent surgeons in the Southern States, and wherein gangrene followed to such extent as to require amputation of the leg, that the great danger of the immediate application of this unyielding (and, as to its solidity, *metallic*) encasement to fractures, dislocations, &c., is the confinement of the part, and therefore total resistance to, and aggravation of, the consecutive inflammation and tumefaction which must necessarily follow all such injuries. It is now proposed, in order to obviate the severe contractions, or even gangrene and destruction of parts, which the dextrine bandages injudiciously applied may and do sometimes produce, that the bandage, as soon as it has become dry, should be *slit down along the whole of its length, in* (for example, cases of fracture of the leg) *the space between the tibia and fibula.* This will allow of some degree of expansion of the limb; and if the sides of the opening are held aside, its condition can be examined. (See Mr. Hey, jun., in *Transactions of the Provincial Medical & Surg. Assoc.*, Lond., 1844. Vol. XII., p. 171, 172; also *Dublin Journ. of Med. Science*, Nov., 1842.) It is to be remarked, however, that this suggestion is by no means new, as it is entirely in accordance with the precautions recommended in this work by Prof. Velpeau, who is one of the most ardent admirers of this kind of dressing.

ANAPLASTY, TENOTOMY, RETRACTION OF THE MUSCLES, &c.

DIVISION OF THE ENTIRE MASSETER.—Having, on the authority of Dr. J. W. Schmidt, of this city, stated in our 1st volume, that he was the first person who first divided the entire masseter, I felt bound in justice to present before the public the counter-testimony of another surgeon, (Dr. Carnochan,) of this city, as addressed by him to me in the way of *réclamation*; which I accordingly hasten to incorporate into this Vol. II., from the New York Journal of Medicine, (January, 1846, Vol. VI., No. 16, p. 59-62,) where it recently appeared. This memoir will be found exceedingly interesting in many other points of view than that of the mere matter of priority of the total section of the masseter.

ART. V.—*Remarks on the Subject of Priority in the Division of the Entire Masseter Muscle; proposed Simultaneous Division of the same and of the Temporal Muscles of one or both sides, and the formation of an Artificial Joint on the Inferior Maxillary, either by a Simple Division of the Bone, or by the Excision of a portion of it; as a Remedy for Immobility of the Jaw.* By JOHN MURRAY CARNOCHAN, M. D., of New York.

TO CHARLES A. LEE, M. D., &c.

Editor of the New York Journal of Medicine.

New York, Dec. 8, 1845.

DEAR SIR,—My friend, Dr. Carnochan, being in Europe at the time of the publication of the first volume of the American edition of "*Velpéau's Operative Surgery*," translated, and with Notes by Professor Mott and myself, it was out of my power to obtain from Dr. C. the details of a remarkable operation which I had understood he had performed some years since in this city, to remedy the "immobility of the lower jaw."

I hasten, therefore, as an act of justice to Dr. Carnochan, to transmit to you the following highly interesting and instructive communication from him, and addressed to me in relation to that subject.

I am, very respectfully, yours,

P. S. TOWNSEND, M.D.

TO P. S. TOWNSEND, Esq., M.D., &c.

SIR :—In your translation of the "*Médecine Opératoire*" of Velpéau, I observe that you insert, in addition to the original article on Tenotomy and Myotomy, a note, in which the credit is given to a gentleman now practising medicine in this city, for having first divided the masseter muscle for that affection which has been termed "Immobility of the Lower Jaw."

I should feel inclined to allow this statement, and the mere matter of priority, to pass unnoticed, although I am in fact entitled, contrary to your statement, to the claim of having been the first to divide that muscle in this affection, five years ago, were it not that the interest and importance of the case I then operated on, appear to merit a detailed account of the treatment adopted by me on that occasion.

In the year 1840, I was consulted by the mother of a girl about 13 years of age, whom, upon examination, I found to be affected with a destruction of the left cheek, extending from the commissure of the lips, to within a line or two of the ascending branch of the lower jaw, and the anterior margin of the masseter muscle. Accompanying this extensive loss of substance of the cheek, was a complete immobility of the lower jaw, by which the upper and lower jaws were kept in close contact; mastication, and even the introduction of solid alimentary materials, being thus prevented, and articulation rendered exceedingly imperfect. This condition of things having existed for several years, the girl was emaciated to a

very great degree, owing to defective nutrition, resulting from the scanty and crude nature of the aliments, which alone could be introduced into the stomach. As both she and her parent seemed ready to submit to any operation which would tend to alleviate her distressing condition, and remove the deformity, I proposed, in the first place, to remedy the immobility of the jaw; and secondly, to repair the loss of substance, by a Taliacotian operation, or by the Indian method of taking a flap from the adjoining healthy parts, and transplanting it to the almost destroyed cheek.

It is in relation to the operation for remedying the immobility of the lower jaw, that I at present wish to call your attention; and although the case under consideration, from its difficulties, and the total ossification upon one side of the temporo-maxillary articulation, resulted only in amelioration, yet I claim, in the operation I then performed, to have generalized certain surgical principles, and to have been the first, in this or any other country, to divide entirely the masseter muscle for that affection; as well as to have suggested the formation of an artificial joint, on the ankylosed side, as a justifiable procedure, when the temporo-maxillary articulation remained in its normal state on the other side.

After having divided the ligamentous, and almost cartilaginous, bridles and adhesions, binding the jaw immovably closed, and applying the screw-lever inserted between the jaws; after the removal of some teeth, the parts not yielding, I passed a narrow tenotome between the masseter muscle and the ramus of the jaw, and divided sub-cutaneously, from within outwards, that muscle, hoping that the division of its fibres would facilitate the liberation of the joint. I now applied the screw-lever again with considerable power, but the jaw still remained immovable. It became almost evident to me now, that the joint, on the side where the ulceration had originally existed, between the glenoid cavity of the temporal bone, and the condyle of the jaw, was ankylosed, or soldered by osseous matter, and that nothing short of fracture or section of the bone would allow the articulation of the other side to play. The hopeless and desperate condition of my young patient induced me to persevere, and before resorting to the *division of the temporal muscle*, towards its insertion at the coronoid process, as a *dernier ressort*, as was my intention, I again applied the lever, and the jaw gave way opposite a groove on the inner side of the bone, which the original ulceration had produced. This having been done, the articulation of the right side being perfect, the mouth could be opened an inch and a half, and the patient was so pleased at the novel sensation of putting her tongue out, and with the idea of having a sight of it, of which she had no previous recollection, that she called for a looking-glass. This result, in appearance, was very well, but a fracture unites like an incision of the soft parts, and for the moment the re-union of the jaws in their fixed position, passed in my mind as the probable result. By the action of the masseter, temporal, and pterygoid muscles of the sound side, and their antagonists, the patient could now move the jaw, and even immediately after

the operation had power enough to masticate. I therefore gave her an anodyne, and applied a loose bandage, and left her to study and reflect upon this somewhat complicated case. Before my next visit, the following morning, the successful attempt of the formation of an artificial joint on the femur, where the coxo-femoral articulation had become ankylosed, first performed by Dr. Barton, of Philadelphia, occurred to me, and I made up my mind to apply this principle to the lower jaw. After the first inflammatory symptoms had subsided, I ordered a wedged-shaped piece of wood to be kept several hours at a time between the jaws, to prevent them from closing, and requested the patient to put into action the muscles of the sound side during the intervals of its removal, and to masticate biscuit, or other solid substances, which she could very well do. The patient was not old enough, however, to understand the importance of the motion being kept up, to bring about the end I had in view, that of an artificial joint, and from relaxing her efforts, after being able to masticate and move the jaw for about three weeks, it became evident that the efforts of the healing process were beginning to produce ossific union. To have maintained the month in a fixed and open position would have been more inconvenient than to have had the jaws permanently approximated; the indications then became, either to *exsect a portion of the lower jaw entirely, so as to insure by loss of substance an artificial joint*, or to adjust the jaws in such a way as to prevent further deformity, after the formation of the callus, and at the same time, if possible, to leave an increased space between the alveolar margins for the more easy introduction of food. The condition of the patient not justifying at that time another operation, which, from its nature, would have been tedious and bloody, I determined upon fulfilling the latter indication, and to wait for the improved health and more mature age of the patient, before attempting the formation of an artificial joint by exsection. With these views I allowed the callus to form undisturbedly, and in about six weeks the jaw became immovable in the approximated position, with the amelioration, as a result of the operation, of a slightly increased space having been gained for the introduction of food.

This, then, is the statement of a case, which, from the frequency of the "immobility of the lower jaw" in this country, generally originating from the too free mercurial treatment of the febrile diseases, endemic in the Western and Southern States, may not be devoid of interest, and may afford some guidance in the operative procedures, that may be attempted in cases somewhat analogous.

In regard to the train of circumstances which suggested the therapeutic means above resorted to, I shall add a few words. Many years ago, while a pupil of the celebrated Mott, I had seen in his practice, and assisted him in many of these cases of immobility of the jaw, in which he always succeeded so as to restore both the functions of articulation and mastication. In one case, however, which occurred in his practice in 1832, that of a young lady from Louisiana, after putting into play the full power of the screw-lever, and

rack-and-pinion-lever, himself and an assistant using simultaneously the two instruments applied between the jaws, the operation had to be abandoned without the least success. After Strohmeyer had given the impetus to tenotomy, and proved its utility, in reflecting upon this case last mentioned, it occurred to me that in those instances where a free division of the adventitious fibres and ligamentous bands, had proved insufficient to bring about the liberation of the articulation, the next indication would be, provided there was not an osseous ankylosis at the temporo-maxillary articulation, to divide at a place of election the masseter and temporal muscles of one, or even of both sides; and I had made up my mind to put these operations into practice, if such a case happened to present itself to me. In my course of lectures on Surgical Anatomy and Operative Surgery, delivered in the winter of 1840, I publicly mentioned these views, and made a dissection of the parts of the lateral regions of the head and face, for the express purpose of demonstrating the practicability and rationality of the section of the masseter and temporal muscles, in this affection of immobility of the lower jaw, *under certain circumstances*. In the same year, the case I have detailed, occurred in my practice, and in the presence of Mr. Eleazar Parmly, Dr. Francis, and other practitioners, now in this city, I made the sub-cutaneous section of the masseter in the manner I have above stated. I was, therefore, as far as I know, the FIRST TO SUGGEST THE DIVISION OF THE MASSETER AND TEMPORAL MUSCLES, in the treatment for immobility of the lower jaw, in those cases in which the division of the other abnormal adhesions had proved insufficient, and where there was not a true ankylosis at the temporo-maxillary articulation, or a doubtful diagnosis existed on that point: as well as the first to *put into practice* the division of the masseter muscle, and to suggest, and endeavor to bring about the formation of an artificial joint, where perfect ankylosis existed on one side, and where the joint of the other side remained natural, and the corresponding muscles retained their normal functions.

The inference to be drawn from the results of this case, which has induced me to mention to you these particulars, and the experiments performed in relation to the re-union of the shafts of the long bones, would lead us to believe, that mere fracture, or section of the inferior maxilla, even accompanied by repeated and free motion, would be insufficient to produce an artificial joint; and that to fulfil this indication, the entire excision of a portion of that bone, either towards the angle, or at some other locality which the nature of the individual case might suggest, would be necessary. The latest, and one of the most distinguished French writers upon Operative Surgery, in speaking on this subject, says, where this affection “est due à une véritable ankylose, alors, l’art ne peut autre chose que pratiquer une voie aux aliments, par l’extraction d’une ou plusieurs dents.” So far, then, as authors have heretofore written, therapeutic means have been abandoned where there was an

anchylosis, on one or both sides, at the temporo-maxillary articulation.

As I have already mentioned, the mere fact of priority would not have induced me to touch, at this time, upon this subject; yet I consider the details themselves of the above case, from its complexity, and the surgical principles brought into play during its treatment of some interest, and as likely to have a bearing upon analogous cases, which, from the frequent occurrence in the country of "Immobility of the Lower Jaw," are not unlikely to be offered to the attention of the surgeon.

I have the honor to be, Sir,

Your obedient servant,

New York, Dec. 6th, 1845.

JOHN MURRAY CARNOCHAN.

The body of the lower jaw has very recently been successfully exsected by an American surgeon, Dr. Simms of Alabama. The case is one of such value in itself, and augurs so encouragingly of the advance of surgical science in the South, that we annex the particulars, (See *Amer. Journ. of the Med. Sciences*, No. XXI., Jan., 1846, Art. XIII., p. 128, &c.)

ART. XIII.—*Osteo-Sarcoma of the Lower Jaw.—Resection [i. e., Exsection] of the body of the Bone.—Cure.* By J. MARION SIMMS, M.D., Montgomery, Alabama.

The subject of this case was a negro man about 26 years of age. The disease involved the body of the bone, extending from the third molar tooth on the left to its fellow on the right side. From the left lateral incisor to the third molar on the right, the teeth had all been removed and their places were occupied by a large granulated, fungo-fleshy looking mass, constantly discharging a fetid sanious secretion. On the left the teeth were firm, but somewhat displaced, being pushed upwards, their crowns inclining slightly inwards. The protuberance on each side of the bicuspids was very elastic to the touch. The whole under surface of the jaw was of a boney hardness, the right of the symphysis being larger than the left, and projecting a little lower.

The following account of the history of the case is from the master of the boy, R. R. Moseley, Esq. :—

"Some five years ago Sam had syphilis, and was some time under the influence of medicine before a cure could be effected. About a year after he got well, a rising commenced on the inside of the jaw, on the right side, resembling a gum boil; but it continued so long that I began to think it was the effect of the medicines he had taken to cure the disease. I got a Doctor to look at it, who pronounced it a gum boil, and as such opened it, but it did not go away. Some considerable time afterwards, I got the Doctor to examine it again. He found all his teeth on that side loose, entirely out of their sockets, and just sticking in the gums. The Doctor then cut down to the jaw-bone and found it diseased, and

matter on it similar to brains. That was fifteen or eighteen months ago. Sam has been taking some kind of medicine for it ever since. This is a short and imperfect account of his case, but about the best I can recollect at present."

The tumor was never painful, but had put on such a frightful appearance, that it warned his master of the necessity of having something done for his relief. He accordingly sent him to one of the most distinguished surgeons of the whole country, who immediately took steps for the performance of an operation. The patient was seated; an incision about an inch long was made on the left side of the jaw, when he resisted the efforts of the surgeon, by springing suddenly from his seat, and refusing to submit to the cutting:—nor could any entreaty induce him to do so. He persisted so obstinately in his foolish determination, that the surgeon was compelled to send him home, trusting that time and a little reflection might bring him to a sense of his danger and show him that his only safety consisted in the extirpation of the disease.

Soon after his return home, his master sent him to Montgomery, hoping that he might yet be induced to undergo an operation. I was not long in ascertaining that it would never be done *with his consent*; his only objection being that "it would hurt too bad."

Having made up my mind to give him the only chance for his life, and having determined not to be foiled in the attempt, I contrived the following method of securing him:—

Everything being ready, the operation was performed on Thursday, 15th May, 1845, at 11 A. M. The apparatus consisted of a barber's chair, on which was placed a plank about twelve inches wide and five feet long, the other end of it resting on a common bench or stool, of the same height as the chair. Persuading him to sit down on the chair with his legs extended out on the plank, he was secured tightly to it by means of straps made of surcingle webbing, which were passed successively over the thighs, knees, and ankles. A strap around the abdomen, or rather pelvis, fastened behind, and another across the upper part of the thorax and points of the shoulders, running downwards and backwards, held him so firmly that it was impossible for him to move his body forwards. Some bands made of the same substance, (surcingle webbing,) fitting accurately each wrist, (after the manner of "handcuffs,") were buckled together with a strong leather strap, and this made fast to the band that passed over his knees, thus keeping his arms extended. His elbows were pinioned to his sides by a strap buckling behind. His legs, body, and hands being now immovable, it only remained to fix his head, which was done by a band passing around it, and having attached, at the occiput, a strong leather strap. By laying hold of this, and pulling directly downwards in the course of the spine, his head was so far controlled that an assistant could hold it in any position that I wanted. He appeared to be very much alarmed. Dr. Baldwin counted his pulse, and found it varying from 122 to 128 beats in a minute.

Taking my position on his right, an incision was commenced on

the left side, a little more than half an inch anterior to the angle of the jaw and continued along the base of this bone to the symphysis. At this cut he made a most furious effort to get loose, which proved that I had not put myself to any *unnecessary* trouble in securing him.

The facial artery being secured, each end requiring a ligature, the incision was continued from the chin, along the right side of the jaw, to a point corresponding with its commencement on the left. The divided ends of the right facial artery, (like the left,) each required a ligature.

The upper flap was dissected rapidly from the tumor and held up in the usual way by an assistant. The lower flap was in like manner dissected off and turned down. This was somewhat tedious in consequence of the thinness of the skin and its close adherence to the diseased mass. The posterior fang of the second molar on the left (its crown being decayed) was extracted to make room for the saw. I attempted to cut the bone with a small, long, narrow saw, but made such slow progress that I laid it aside and picked up a very strong pair of Liston's bone forceps, with which I was equally unsuccessful. I then resorted to the chain-saw, passing it around the bone in the manner usually directed, by which it was severed in a few seconds. Its application on the right side was quite as successful, dividing the maxillary just anterior to the third molar tooth. A strong double ligature was now passed through the frænum linguæ to prevent the spasmodic retraction of the tongue, and the operation was completed by dissecting the lingual muscles from their attachments to the bone. The retraction of the tongue was pretty strong at the moment of separation; though easily controlled by the ligature, which proved the safety and utility of this precautionary measure. There was a good deal of hemorrhage from the nutrient vessels of the diseased part: but no ligature was needed. The operation lasted forty minutes. From his constrained position and loss of blood the patient was quite exhausted. He was loosed from his fetters, laid on a bed, and took some brandy and water; which, by the bye, had been given to him occasionally during the operation. The wound was not adjusted, till reaction had been fully established and the oozing of blood entirely checked. The ligatures of the facial arteries were left hanging from their respective places. The ligature of the frænum and those of the ranular arteries were drawn through the opening at its central point; the wound was closed by some six or eight interrupted sutures, and a water dressing applied. He had taken sixty drops of laudanum previous to the operation, which did not appear to produce any effect till it was over, when he seemed almost narcotized, sleeping profoundly the whole afternoon and all night. Mr. Norris, one of my students, sat by his bed-side the whole night, watching his tongue and keeping the dressings constantly moistened with cold water.

The frænum linguæ ligature was cut loose and drawn out on the second day; but the dressing was not disturbed till the fourth,

when I found the wound healed through its entire extent by the "first intention," except just at the points where the ligatures hung out. They came away in due time, and their points of exit at the chin and on the right side granulated directly; but on the left there remained a fungous growth sprouting up above the level of the surrounding skin, about the size of a pea, which did not get well till an exfoliation of bone was thrown off through this opening. On the right there was a like exfoliation, but it was discharged by an opening on the inside of the mouth.

For several days I observed that when he would lie on one side, the large, flabby, *skinny* chin would gravitate to that side; and when he would lie on his back, its own weight, assisted by the inspiratory act, would cause it to *cave in*, as it had no support on the interior.

Sam left Montgomery on the 12th July, perfectly well. Previous to the operation, he was never known to laugh or even to speak to any of the other patients in the Infirmary; but now, his mouth is almost always on the broad grin, and he is continually cracking jokes and playing pranks on his companions. I have rarely ever seen a patient exhibit more real heart-felt gratitude than he does.

His mastication is very good, having the third molar tooth left on each side; but the action of the pterygoid muscles has a tendency to draw the ends of the bones inwards, and thus mastication is performed, not with the crown, but rather with the outer edge of the tooth. This, I fear, will, by and by, cause them to become displaced, loose, and useless.

The operation was performed in the presence of a large number of medical gentlemen,* and I am under especial obligations to Drs. Boling, Baldwin, Blakey, Bellangee and Vickers for their valuable aid.

A review of this case presents to my mind the following points of interest.

1st. It adds another to the long list of successful operations for this disease.

2d. It proves the practicability of the operation, whether the patient is willing or not.

3d. The chain-saw is to be preferred for the division of the bone, when it is of a *healthy hardness*. It is a *labor, time, and pain-saving instrument*.

4th. There is safety in the frænum linguæ ligature.

5th. The water dressing is preferable to every other.

6th. If any apology were necessary for the length of time (forty minutes) taken in the performance of the operation, it might readily be found in the constrained posture of the patient, and consequently the increased urgency for rest, which, according to my experience, is all important in any capital operation.

If I had to do this operation again, I would not bring a single ligature through the wound, but I would leave them long, bring

* Ten medical students and fifteen doctors.

them out at the angles of the mouth and fasten them to the cheeks with adhesive plaster, thus allowing the wound to heal up entirely by the first intention, and avoiding the deformity of a cicatrix from granulation.

Keratoplasty, or *transplantation of a new cornea*, which, though touched upon by our author, (vid. text, Vol. I.) is deemed of an experimental character too hazardous and empirical almost to be spoken of, otherwise than as an operation to be absolutely proscribed, we perceive, nevertheless, continues to engage the attention of some practitioners in France as well as in Germany. M. Desmarres, (*Archiv. Gén. de Méd.*, 4e sér., Paris, Nov., 1843, t. III., p. 363,) at the sitting of the Paris Academy of Sciences, Oct. 2, 1843, states that he has ascertained that the *cornea of a rabbit* may with much facility (*assez facile*) be engrafted upon that of another animal of the same species; but that the transparency of the new graft (*lambeau*) is generally deficient, (*ordinairement nulle*,) at least in the greater part of its extent. The new cornea first swells, then becomes gradually flattened, and contracts so as to become diminished in all its diameters to *two-thirds* of its primitive dimensions, though preserving the exact form of its original periphery. In its retraction, it draws to it concentrically the border of the former cornea, which latter, singular as it may appear, becomes elongated sometimes to six times the breadth of what was pared off. Hence if, in transplanting, we take care to remove a flap of the iris, the *widening* of the remains of the *old cornea* gives free passage through it, and through the aperture in the iris to the retina, whereby vision is established, but not through the transplanted cornea.

The application of *anaplasty* for the cure of *ranula*, by M. Jobert of Paris, which we have alluded to in our *Concluding Appendix*, Vol. I., but could not at the time find the details of, consists in the adaptation of this remedy to this disease upon the same principles upon which it is used for the cure of contractions of natural orifices. In the first stage, the surgeon carefully dissects off from the tumor, without penetrating the latter, its mucous membrane or external envelope, the dissection being made to an extent proportionable to the volume of the ranula. He then excises a flap, so as to obtain a bleeding surface of a certain extent. The second stage consists in opening and evacuating the pouch, (or sac,) by incising the internal membrane which remains. Finally, he reverses this internal membrane on each of the lips of the incision, and doubles it upon itself so as to fill up the bleeding surface, and keeps it in this position by means of a point of suture acting as a hem, (*en ourlet*.) (Vid. Dieffenbach's Ingenious Process for Atresia or Contraction of the Mouth: text, Vol. I.) M. Jobert proposes thus to create a permanent opening, as in the processes of Dupuytren, Boyer, &c.; the obliteration, however, here being, in his mode of operating, less to fear, because the borders of the orifice are, by the very fact of the operation, made to consist of *non-bleeding* (*non-saignantes*) surfaces, which can neither approximate nor

unite, (*Annales de la Chirurg. Franç. et Etrang.*, Juin, 1843; also *Arch. Gén. de Méd.*, Paris, 4e sér., Sept., 1843, p. 100, 101.) M. Jobert proposes to extend this process to imperforate passages or cavities, as the vulva, mouth, &c., by first laying them open, and then bringing out the mucous membrane and hemming it by pin sutures to the cutaneous border of the external wound, (*Archiv. Gén. de Méd.*, 4e sér., t. II., Juin, 1843, p. 238.)

At the sitting of the Academy Royal of Medicine of Paris, August 1, 1843, we notice a second report of our author, M. VELPEAU, on a memoir of M. Debrou, which latter, in cases of *hare-lip*, with a considerable projection of the inter-maxillary bone, proposes, after the manner of M. Vallet, to exsect a triangular portion at the lower part of the septum, so that the projecting bone, deprived of its pedicle, may be more easily crowded back, and allow the reunion of the two portions of the lip with the median tubercle. M. Velpeau, in referring to a similar operation by M. Blandin, (vid. also text and Appendix of Vol. I.) considers that of M. Vallet anterior to his. He also expresses an opinion that the process might be modified and simplified by means of a *vertical section* of the septum, (cloison,) which would allow of the pushing back of the inter-maxillary bone. M. Blandin, it appears, claimed priority over M. Vallet, (*Arch. Gén. de Méd.*, Paris, 4e sér., t. III., Sept., 1843, p. 108.) This, we should judge, was in fact nothing more than a new application of the *wedge-shaped exsections of bones*, as first practised by J. R. Barton, of Philadelphia, (vid. text of this work, Vol. I.) M. Blandin, in the January number of the *Journal de Chirurgie*, 1843, preceding the above, gives, in detail, the steps of the operation which he claims. M. Blandin advises the base of the exsected wedge to face downwards, and its apex to reach to near the bridge of the nose, (dos du nez,) which would make it a sharp triangle. The only difficulty is, some hemorrhage from the arteries of the septum. To arrest this, he uses torsion; and, for greater security, does not proceed to unite the fissures in the lips till two or three days after the above operation. (Vid. *Archiv. Gén. de Méd.*, 4e série, t. I., Mars, 1843, p. 365; also Dr. Mott's Process, Supp. Append. of M. Velpeau, Vol. I.)

Contractions of the limbs, in cases of cerebral hemorrhage and other lesions of the brain, are, as noticed in our Concluding Appendix, Vol. I., attracting of late a good deal of observation among English as well as French surgeons. In a very interesting paper on this subject, by M. le Docteur Max. Durand-Fardel, (*Arch. Gén. de Méd.*, Paris, 4e sér., t. II., Juillet, 1843, p. 300, et seq.) he maintains the almost constant presence of these contractions, either in the paralysed or non-paralysed limbs of hemiplegic cases, from cerebral effusion into the pulpy substance of the brain; and states the singular fact, that these contractions have escaped the notice of most investigators. Thus it was merely alluded to by M. Rochoux, (*Recherches sur l'Apoplexie*, 2e edit., p. 142,) but is not even mentioned in the works of Portal, MM. Moulin, Abercrombie, and Andral; while M. Lallemand appears to think, on the other hand,

that flaccidity of the limbs is constant in hemorrhage, (Lallemand, *Lettres sur l'Encephale*, let. 2, p. 259,) and M. Gendrin is still more positive in this opinion, (*Traité Philos. de Méd. Prat.*, t. I., p. 583.) M. E. Boudet was the first to make this subject clear, (*Mém. sur l'Hémorrhagie des Méninges*, 1839.) He states, in his work, that *contraction* will not be found where inflammation does not extend into the cerebral pulp, beyond the walls of the effusion, (foyer;) but where the lesion of the cerebral pulp is accompanied with rupture through the walls of the ventricles and effusion of blood into its cavities, or upon the surface of the brain, contraction supervenes. In *eighteen* cases of *ventricular* hemorrhage, M. Durand-Fardel found that thirteen had contraction of the paralysed limb, two contraction on the non-paralysed side only, and three were of simple resolution without contraction. In eight cases of hemorrhage on the exterior of the brain, there were six cases of contraction of the paralysed limbs, one of contraction of the non-paralysed limb, one of simple resolution.

He thinks that, in certain cases, the march of the effusion during life may be measured by the contraction. This surgeon concludes as follows:—

“That, in cerebral hemorrhage, the contraction of either the paralysed or non-paralysed limbs, almost constantly accompanies the rupture of the bloody sac (foyer) into the ventricles, or into the meningeal coverings.

That the contraction shows itself but very rarely, as a consequence of hemorrhages limited to the substance (épaisseur) of the hemispheres.

A most important point, certainly, in relation to tenotomy and myotomy, is to diagnose correctly between such contractions as are the result of almost irremediable and hopeless lesions, like the above, and those which, whether from primary cerebral or spinal lesions or not, terminate in such permanent alterations and deformities of the tendinous, muscular, and osseous parts, as to require the use of the tenotome.

In noticing Professor Mütter's late work on *Cases of Deformities from Burns*, (Philadelphia, 1843,) the editor of the London British and Foreign Medical Review, (Oct. 1844,) speaks of a case which fell under his own observation, and in which a *plastic* operation having been attempted for a loss of teguments involving the axilla, upper arm and side, the efforts of the patient to resist the contraction of the cicatrix, though an apparatus was also used to support the side and arm, were so great as to produce a *commencing curvature* of the spine.

At the sitting of the Academy of Sciences, Feb. 19, 1844, (*Gaz. Méd.*, t. XII., p. 125-6,) a memoir, transmitted from M. Maunoir, of Geneva, was read, on the *muscularity of the iris*, which he proposes to demonstrate on the strength of a long series of experiments. The iris, he says, is composed of an epiderm, or rather an epithelium, mucous substance, (corps muqueux,) two muscles, viz., a dilator and sphincter, cellular membrane, pigmentum nigrum, and

a cellular membrane enveloping and reciprocally limiting all those parts. In man the two muscles seem one, the external or radiating, which originates from an aponeurosis, called the ciliary ligament, which is found at the periphery of the transparent cornea, at its junction with the sclerotica. The fibres of this muscle fall perpendicularly upon the great circumference of the orbicularis or sphincter muscle; the little circumference of this latter forms the pupil. The radiating or dilator muscle occupies nearly three-fourths of the disc of the iris, and the sphincter one fourth. Galvanic experiments confirmed these researches of M. Maunoir. In his microscopic experiments on animals, he found the iris variable, but the muscular arrangement unchanged. Finally, he was enabled by accident to demonstrate conclusively the *antagonism* of the *constrictors* and dilators of the pupil, by a case in which, from a wound in the cornea from the point of a knife, a small artificial triangular pupil was accidentally formed above the line of the cicatrix and near the normal pupil, which latter constantly contracted as the other dilated, and vice versâ.

A *new application* of tenotomy and myotomy, and which, in our opinion, promises to be one of great value, has been recently made by M. *Fabrizi*, an Italian surgeon, (*Gaz. Méd. de Paris*, tome XII., 1844, 17 *Août*, p. 526, et seq.) viz., to the division of muscles or tendons implicated in contractions in consequence of old *suppurating wounds*, in which the matter penetrating and burrowing, and forming sinuses in the midst of the deep-seated tissues, tediously prolongs the cicatrization. M. Fabrizio has operated in four cases of this kind; in the first of which the suppurating wound being in the arm, and involving at its bottom the tendon of the biceps, that tendon was divided near its insertion into the radius; in two others the burrowing wounds being in the calf, and causing in one instance a complete talipes-equinus, and in the other contraction of the gastrocnemii, (jumeaux,) the tendo Achillis below was divided; and in the fourth, the wound being in the fore-arm, and causing permanent flexion of the hand, he divided the tendon of the palmaris longus, and the flexor carpi ulnaris, (cubital interne.)

In every instance, the operation aided by the subsequent treatment of *Massage*, to relax the muscles, and suitable injections of iodine, &c., effected a perfect cicatrization and speedy cure. It is to be noted, in support of what we have said, (Preface, Vol I.,) that the division of the biceps cubiti on the seat of the wound, was an effective resource in promoting the cure by *dilating the wound* and its burrowing sinuses, and *exposing them freely to the air*, not by a *sub-cutaneous operation* and *occlusion of the air*; while the other three cases were rigidly sub-cutaneous, and the advantages they procured in promoting cicatrization were, undoubtedly, as the author of this new application of tenotomy says, imputable to the relaxation of the parts about the wound, the removal of the tension and bridles, &c., and therefore, though not directly performed on the seat of the disease itself, proved eminently serviceable as an auxiliary sub-cutaneous resource.

As the cases are rare in which the division of the *tendons or muscles of the fore-arm* is called for, it is well to note here that in a case in which a cicatrix on the fore part of the fore-arm had caused this part of the limb to be slightly flexed in strong supination, the wrist to be drawn into abduction, and the thumb and other fingers to be contracted; while the tendons of the extensor ossis metacarpi pollicis and the flexor brevis pollicis were strongly salient in front of the styloid process of the radius, M. Balassa, of Vienna, as early as Dec. 13, 1841, successfully divided with Wattmann's tenotome, the tendons of the above two muscles in front of the styloid process of the radius, and immediately the forced abduction of the hand ceased. He then completely separated the cicatrix from its attachments, and kept it thus isolated between the muscles and skin. The extension of the hand and fingers was now effected without the least difficulty, (*Gaz. Méd.*, tome XI., 1843, Jan. 28, 1843, p. 62.)

An interesting specimen, illustrative of the *organic plastic process and intermediary deposit* which take place in divided tendons, was exhibited by M. Bérard, at the sitting of the Royal Academy of Medicine, of Paris, March 28, 1843. The patient was a female aged 24, upon whom M. Bérard had divided the tendo Achillis on one side for a double pes equinus, and who died six months afterwards of a pleuro-pneumonia. The tendon operated upon was four centimeters longer than the other. The new material was found to be a fibrous substance *whitish on its surface, and rose-colored in its centre*, where vessels still existed. It was intimately adherent, and united in its extremities with the cut ends of the tendon. M. Rochoux contended that the intermediary substance and the normal tendon, however analogous in appearance to the eye, were not in reality so, as had been ascertained by the microscope, (*Gaz. Méd. de Paris.*)

M. Sédillot, of Paris, going farther than ourselves against (See Preface, Vol. I., &c.) giving too great a *generalization* or extension to *sub-cutaneous surgery*, says in fact, in his memoir, (to the Academy of Sciences of Paris, June 12, 1843, entitled *De l'Innocuité de la Tenotomie*, &c., Vid. *Gaz. Méd.*, t. XI., 1843, 17 Juin, p. 382,) that "*all the applications of the sub-cutaneous method made in other than (en dehors) fibro-tendinous and muscular sections, have proved failures,*" and he regards "*as erroneous, the generalization of the sub-cutaneous method to all the operations which may be performed under the integuments;*" on which M. Jules Guérin, in a note, (*Gaz. Méd.*, *Ib.*) calls for proofs, and then adds, that he maintains the opinion diametrically the reverse of M. Sédillot, and asserts that in all the applications he had made of the sub-cutaneous method, outside of, or beyond, the limits of tenotomy, have, *without a single exception*, proved that *all sub-cutaneous wounds without abnormal complications*, be their seat what it may, enjoy the same immunity as the wounds of tendons.

The Action of the Oblique Muscles of the Eye.—The subject of the action of the muscles of the eye, to which we have devoted

much space in our Vol. I., as connected with the important operation for strabismus, is still, we are pleased to see, attracting the attention of surgeons. (See Ranking's *Half-Yearly Abstract*, &c., Amer. edit., New-York, 1845, Vol. I., p. 270-271.)

M. Bourguery, (*Med. Gaz.*, Jan. 1845, p. 462,) finds that the mean weight of the encephalon, or central nervous mass being 20393·5 grains troy, the cerebral hemispheres stand for 16940·46 grains of that quantity, the cerebellum for 2176·7 grains, the cephalic prolongation of the cerebro-spinal axis for 1312·2 grains, of which the *optic thalami* and *corpora striata* take 879·9 grains; the medulla oblongata, with the pons varolii, 432·2 grains, and the spinal cord 710·1 grains. Hence, in man, the cerebral hemispheres include a nervous mass which is *four* times that of all the rest of the cerebro-spinal mass, *nine* times that of the cerebellum, *thirteen* times that of the cephalic stem of the spinal cord, and *twenty-four* times that of the spinal cord itself.

The Eye.—Action of the Oblique Muscles. Dr. George Johnson (*Cyclopaedia of Anatomy and Physiology*, art. Orbit., p. 791) has performed some experiments to determine the action of the oblique muscles of the eye, and has obtained results similar to those arrived at by Volkman, (*Muller's Archiv*, 1840-1-2. See also the pathological evidence by Szokalski, and other confirmatory facts in Longet, *Du Système Nerveux*, tome II., p. 396,) and others, proving the truth of Hunter's opinion, that these muscles rotate the eyeball on its antero-posterior axis, (*Palmer's Edition of Hunter's Works*, Vol. IV., p. 274,) and so keep the eye steadily fixed on an object we are regarding, during certain movements of the head, as from shoulder to shoulder, (the effects of which are not corrected by the recti muscles, and thus enable the image of the object to be kept on the same point of the retina, and not to be allowed to move over its surface, which it would do, during these movements of the head, were there no oblique muscles to counteract this tendency. In Dr. Johnson's experiments, a dog was killed by the injection of air into a vein, and immediately the inferior oblique muscle was exposed by dissecting off the conjunctiva without in any way interfering with the surrounding parts; by means of two fine wires, a slight electric current was then directed through the muscle. The effect was a rapid rotation of the eye upon its antero-posterior axis, so that a piece of paper placed at the outer margin of the cornea passed downwards and then inwards towards the nose. The superior oblique was then exposed at the back of the orbit, and was treated in the same manner. The rotatory movement produced was precisely the reverse of the former; the paper at the outer margin of the cornea passed upwards, and then inwards towards the nose. In the case of the superior oblique the movement was less extensive, the irritability of the muscle being less, perhaps from the delay in exposing it, and from some slight injury inflicted on it in so doing. There could be no doubt as to the direction of the movement in both cases; there was not the slightest appearance of elevation, depression, abduction, or adduction of the cornea. The experiment

was subsequently repeated on another dog, with precisely the same result.

Diseases of the Heart, Aneurism, &c.—Having expressed ourselves, under the high authority of Dr. Mott, rather doubtfully of the value of auscultation in sub-sternal and thoracic aneurisms, (See text, Vol. II.,) we deem it a matter of justice to make a slight reference to those who entertain a contrary opinion, among whom we confess the names of such authorities as Bellingham, Corrigan, &c., to which we may add that of so profound an anatomist, skilful a surgeon, and accurate an observer as DR. JNO. MURRAY CARNOCHAN, of this city, (New-York,) are well calculated to arrest our judgment. We quote from Dr. Ranking's *Half-Yearly Abstract of the Medical Sciences*, American edit., New-York, 1845, Vol. I., p. 212-213, some remarks which are apposite to the subject:—

Diseases of the Heart.—The contributions to the study of the diseases of the heart and great vessels during the preceding six months are principally those by Drs. Bellingham, Furnival, and Christison, and MM. Forget and Gendrin. The observations of Dr. Bellingham, which will be found at length in another part of this work, (19,) are valuable for the clearness with which the physical signs of valvular disease in particular are laid down. In common with the majority of auscultators, he considers regurgitant diseases of the mitral valve, to be indicated by a "bruit" with the first sound, most distinct under the left nipple. In regard to this point we may be allowed to state, that it has long been our opinion, founded upon careful clinical observation, that disease of the mitral valve does not give rise to any bruit whatever, and that in fact we have no means of diagnosing the lesion, excepting by reference to the pulse, which is in itself almost pathognomonic. In looking lately through a list of cases of mitral valve disease, we have been able, within certain limits, (not as extensive as might be wished, it must be allowed,) to gain a numerical confirmation of these views. Of 14 cases of mitral disease, as ascertained by post-mortem examination, a bruit with the first sound existed in 8, and none in 6. This at first sight might appear to favor the common opinion; but we further find that out of these 8 cases, another cause capable of generating the "bruit," namely, obstructive disease of the aortic valve, existed in 6. On the other hand, in the 6 cases of patulous mitral valve in which no bruit was perceptible, neither was there, with one exception, any co-existent disease of the aortic orifice. The exception alluded to, it may also be observed, is not in reality, one to which any value can be attached, for the aortic orifice was in that case reduced to a rigid narrow ring, a condition which is generally allowed to be incapable of generating a bruit. We conclude, therefore, as far as so small a number of observations will warrant our coming to any deduction at all, that a patulous condition of the mitral valve does not give rise to a "bruit," but that the sound heard in such cases is due to a co-existing lesion of the aortic orifice.

Dr. Furnival's work (*Diagnosis, Prevention, and Treatment of Diseases of the Heart, &c.*, Svo., London, 1845) is a careful resumé

of the ordinarily received doctrines of the day, but adds little to our previous knowledge. He particularly insists upon the advantage of giving alkalies in the treatment of acute rheumatism, as a means of preventing cardiac complication. The formula preferred by him is:—*Liq. potassæ* 3 ss; *Vin. colchici* ℥ xx; *Infus. sennæ*, or *Aquæ menthæ* 3 j three times a day. He likewise speaks highly of aconite as a sedative in heart disease, and considers it in all cases preferable to digitalis.

M. Forget (*Memoir to the Acad. des Sciences Médicales*; reported in *Lancet*, Nov. 1844) considers that too much value is attached to valvular sounds in the diagnosis of diseases of the heart. He thinks that, in order to arrive at a correct diagnosis, it is necessary to determine the relative frequency of the lesions of the different orifices, and the relations of those lesions to hypertrophy and dilatation of the parietes. The results of the analysis of several hundred cases have shown him, that the most conclusive sign of a contracted aortic orifice is dilatation, and generally also hypertrophy of the left ventricle. This is indicated by a *bulging in the precordia*, increased impulse, and bellows-sound along the track of the aorta. This state of the left ventricle implies also passive dilatation of the other three cavities, so that in diseases of the aortic orifice the whole heart is enlarged, giving rise to increased dull space in the precordial region. Contraction of the mitral orifice is followed by dilatation of the three cavities behind it, but the left ventricle remains undilated. In this case there is neither precordial bulging, nor increased dulness on percussion.

The practical deductions drawn by the author from these views are,—that in aortic stricture, with hypertrophy and dilatation of the left ventricle, debilitants and sedatives may be used without fear; whereas, in cases of mitral stricture, these means must be used with caution, as the left ventricle not being thickened, requires all its energy.

Pericarditis.—The occurrence of this disease, as a complication of scarlatina, has already been mentioned, (vide p. 3.) Mr. Sibson (*Op. cit.*, p. 523) speaks of a mild form of pericardial inflammation, which he believes to occur some time or other in the life of almost every individual. He is induced to come to this conclusion, from finding a small quantity of fluid, and a delicate fibrinous deposit on the auricular appendages in the majority of post-mortem examinations in persons dying of lingering disease of the chest, injuries, &c.

Aneurism.—The diagnosis of aneurisms of the aorta forms the subject of a comprehensive paper by M. Gendrin, for which we refer to our notes under arteries in this volume, and is also briefly alluded to by Dr. Furnival, (*Op. cit.*, p. 176.)

A peculiar form of dissecting aneurism of the aorta has been described by Dr. McDonnell, (*Med. Gaz.*, March 2, 1845,) in which the blood had taken a double course, one downwards behind the sigmoid valves, which eventually burst into the pericardium, the other upwards, separating the arterial tunics as far as the innomi-

nata and subclavian vessels. The symptoms of this lesion are well shown in a similar case which is recorded by Dr. Todd in the 27th volume of the *Medico-Chirurgical Transactions*. These appear when the disease occurs suddenly, to be in the first place, a state of syncope, which is evidently due to the sudden abstraction of a large quantity of blood from the general circulation, and its impulsion into the new-formed channel. The tearing away of the cellular tissue connecting the coats of the artery before the column of blood, was in the above case announced by severe anomalous pain in the course of the arterial trunk.

Lesions of the Large Arterial Trunks.—Fatal lesions of, and hemorrhage from, the aorta and other large neighboring trunks, as the *carotid, subclavian, and pulmonary arteries*, by foreign bodies arrested in the œsophagus, are not unfrequent occurrences. Dr. Duncan, one of the surgeons of the Royal Infirmary of Edinburgh, relates, during the year 1844, (Cormack's *Lond. & Edinb. Month. Journ. of Med. Science*, Oct., 1844, p. 862, etc.) the extraordinary case of a man aged twenty-two, a journeyman dentist, who, having been in the imprudent practice of wearing during sleep two artificial, superior anterior incisors, which he had adjusted in place for the two that had been lost, and which, for the sake of concealment, were badly secured by springs, accidentally found, on awaking one morning, that they were missing, which induced him to believe that he had swallowed them, of which he was unhappily convinced by the difficulty and pain he experienced in attempting to swallow. Mr. Syme, to whom he applied for assistance, detected, by means of the probang, a foreign body in the œsophagus, considerably below the cricoid cartilage, and much beyond the reach of the ordinary forceps used for extracting foreign bodies from the gullet. The swallowing having improved, it was thought the teeth had passed into the stomach; but the pain continued, and some small quantities of blood were spit up. About nine days after the accident, he suddenly fainted and vomited a mouthful of blood. The attempt to introduce a forceps now brought on vomiting of blood in considerable quantities, viz., to eight or ten ounces, when the false teeth were brought up; but this was immediately followed by several mouthfuls of *bright arterial blood*, when the lips became livid, the pulse ceased, and the patient expired in convulsive sobs.

On careful examination of the parts, says the narrator, (Dr. Duncan,) the œsophagus, stomach, and duodenum were found distended with *eight or ten pounds* of bright arterial blood. There was an ulcerated perforation of the anterior part of the œsophagus, about four and a half inches from the rima glottidis, about three-fourths of an inch in length, and three lines in breadth, passing obliquely upwards from the right to the left side. The edges of the perforation were rounded, and there was considerable surrounding injection of the mucous membrane. By this opening, the probe could be readily passed into the aorta, which vessel, after keeping the parts a day or two immersed in spirits, was found to contain a per-

foration about the size of a large crow-quill, about half an inch below the origin of the left subclavian. The opening was irregular, with the edges everted, and at the lower part there was a pretty firm adherent coagulum. There was little or no vascular injection around the opening. The artery was otherwise perfectly healthy. The gold plate of the teeth was large, with projections corresponding to the spaces between the adjoining teeth, the two last on both sides being large and pointed, with almost a cutting edge. A more dangerous instrument for lodgment near the aorta could not well be imagined, and it was owing to its curved form, Dr. Duncan thinks, that the probang passed freely by it, in the second attempt to introduce that instrument. This rare and instructive case *inculcates*, he remarks, *the necessity of removing foreign bodies from the œsophagus as early as possible.*

Such foreign bodies sometimes occasion suffocation immediately, or inflammation and suppuration, followed by ejection of the body by the mouth, or its descent into the stomach; or the suppuration may be so extensive that it makes its way, as in the case recorded by Hofer, into the chest, and causes death in that manner.

In the case of a soldier, and which occurred in India, as related to Dr. Duncan by Sir G. Ballingall, death followed extensive gangrene of the parts, from a bone impacted in the gullet. Sometimes the body has escaped externally by suppuration; at other times the trachea has been perforated, and death thereby caused; or it has formed a pouch and been afterwards ejected by vomiting, even after the lapse of fourteen or sixteen years.

In the *Dictionnaire de Médecine*, (1840,) three similar cases to the above are related of fatal hemorrhage: one by Martin, of a soldier, who, swallowing coin for a wager, had one of the pieces lodged in the œsophagus, so that fifteen days after, it perforated the aorta nearly at the same point as the false teeth in Dr. Duncan's case, and caused vomiting of blood and death; the two other cases are by Wagret and Saucerotte. Dumoustier, in the same work, relates a similar case from a wound in the carotid; also Bégin, at the Val-de-Grâce, gives the case of a soldier who swallowed a piece of bone, which, though getting out of the reach of the probang, continued to produce pain, and several weeks after brought on vomiting of seven pounds of blood, ending in death. Two parallel ulcerations were found in the upper third of the œsophagus—the one on the right side nine lines in breadth, and that on the left, twelve. Opposite the latter there was an adhesion between the œsophagus and the corresponding part of the carotid, in which latter there was a small erosion about a line in diameter, which was undoubtedly the outlet of the hemorrhage and the cause of death.

Guthrie, in his work on the Arteries, relates a case of a soldier in whom both carotids were wounded by swallowing pins. Mr. Bell, of Barhead, (*London Medical Gazette*, Feb. 10, 1843,) gives a case in which the right carotid was perforated by a needle accidentally swallowed. In a case related by M. Bernast, of the Toulon Hospital, communicated to M. Bégin, the pulmonary artery was wound-

ed, in a soldier, from swallowing a sharp piece of bone, which penetrated the vessel by a minute opening at its point of bifurcation, to be distributed to the lungs, causing intense lancinating pain, inflammation, and, on the 8th day, vomiting of some blood and effusion of a large quantity of that fluid into the chest, causing death, (*London Med. Gaz.*, May 11th, 1843.)

The right *subclavian* has also been thus wounded in a case related by Mr. Kirby, (*Dublin Hospital Reports*, Vol. II.,) in which this vessel rose from the left side of the aorta, and passed to the right, behind the œsophagus, (*Northern Journ. of Medicine*, May, 1844.)

Necessity of Opening Abscesses early.—Danger of Perforation of Large Arterial Trunks from Deep-seated Abscesses.—Professor James Miller, of the University of Edinburgh, in enforcing the necessity of early evacuating *acute* abscesses, especially such as are occult or deep-seated, remarks of these latter, (see his *Principles of Surgery*, Edinburgh, 1844, p. 184–187,) that it is now conceded that if neglected, as in the neck for example, where the pus is bound down by the cervical fascia, they frequently make themselves an opening into the œsophagus or trachea; and that “recently examples have not been wanting of still greater hazard, by *perforation of either the carotid or the internal jugular.*” In these views of speedy and also the necessity of *free dilatation* of abscesses, we fully concur with him, as contradistinguished from the now perhaps too fashionable tendency, founded on the growing popularity of *sub-cutaneous* surgery, of favoring too much the *doctrine of occlusion*, of cavities, articulations, &c. Nevertheless, this author’s new, peculiar, and unsustainable idea, that *ulceration* is not the result of *absorbent action*, but of *inflammatory disintegration and softening*, is one which we must dissent from, as having a very anomalous and questionable shape, in juxtaposition as it is with the plain common sense maxims of his book.

Anomalies in the Arteries of the Neck.—Dr. Darling, Demonstrator of Anatomy in the University of New York, mentions to me a singular anomaly which he has recently met with in the arteries of the neck on the right side, a very elegant specimen of which may be seen preserved in his museum at the university. The pleura of the right side ascends as high as the fourth cervical vertebra, and extends so far to the left side as to have pushed to the left side of the median line the arteria innominata, and the origins of the right carotid and right subclavian arteries. So great is this displacement, that the right carotid, which, with the right subclavian, lies on the upper and anterior part of the pleura, is obliged to make a curve of about two inches in length, with the convexity forwards, in order to reach its normal situation. The left carotid and left subclavian are normal. It may, he continues, (private communication, Jan., 1846,) be interesting to state, that the appearance of the subject (a female aged about 50 years,) was very remarkable. Her neck was exceedingly short and thick; her whole person very squatty and wonderfully corpulent, so much so that the upper part of the thigh measured nearly two feet in circumference.

In another case, of which the specimen is also preserved in the same museum, the right subclavian arises to the left of the left subclavian, from the posterior surface of the arch of the aorta, and passing behind the left subclavian and left carotid, and the trachea and œsophagus, reaches its ordinary situation.

Hemostatic Means.—M. Morand, (*Journal de Médecine*; see *Lond. Lancet*, Oct. 5, 1844, p. 34,) to arrest leech bites, applies with success a cake of oil and yellow wax over the orifices. Dr. Bordes (*Jour. de Chirurg.*) found the introduction of a pin through the lips of each orifice, and the twisted suture as in veterinary practice, perfectly effectual. The more simple and most efficacious mode is that which I have already described, (see vol. I.,) of passing a fine needle of white silk through the lips of each bite, and securing it with a knot. In some cases, where the bite is large, I have found two of these sutures necessary. The arrest of the hemorrhage is instantaneous, and this resource is of infinite importance in loose tissues, where pressure cannot be made, *i. e.*, where there is no point d'appui, as on the neck, abdomen, &c.

Ligature on the External Iliac, by Mr. Liston of London, in the recent case of fatal duel.—As we have alluded to this important case, which we perceive has given rise in England to many disparaging remarks, we think it due to the eminent surgeon in question to give the following abrégé of the Reports made upon the case, which are deemed most authentic by, we believe, Mr. Liston himself. They will be found in detail in various recent periodicals, viz.: *The Lancet*, *Medical Times*, &c.; also in *Ranking's Half-Yearly Abstract of the Medical Sciences*, American Edition, New-York, 1846, Vol. II., p. 118-119-120.

LIGATURE OF THE EXTERNAL ILIAC ARTERY *for a circumscribed false Aneurism from the division of a superficial branch of the femoral artery by a pistol shot; a suspicion being entertained that the femoral trunk was wounded.* By MR. LISTON. (*Condensed from the Reports and Commentaries in the Lancet, Medical Times, &c.* By DR. POTTER and others 1845

On the evening of the 20th of May, Mr. Seton received a wound from a pistol ball, which, entering the upper part of the right thigh a little above and in front of the great trochanter, and crossing the abdomen, passed out about the middle of the fold of the left groin.

No surgeon was present, but the non-medical witnesses of the event describe the hemorrhage which occurred as rapid, the blood being florid, in large quantity, and issuing *per saltum* from both wounds; and as rising when uncontrolled in a jet to the height of two or three feet from the wound in the right hip. Attempts were made to arrest the hemorrhage by pressure over the wounds, but the patient fainted, and the hemorrhage ceased.

When first seen by a surgeon, the patient appeared almost lifeless, but was restored by proper measures. The following day the temperature of the surface became more natural, the pulse increas-

ing in rapidity and somewhat in strength. The track of the ball was marked by an elevated ridge, from one opening to the other, and some ecchymosis of the skin extended from this line over the lower part of the abdomen and scrotum. The patient suffered great pain in the groin and right lower limb generally, with a sensation of numbness of the front of the thigh, and partial loss of power over the muscles of that part of the limb. Subsequently, the application of iced-water and bladders of ice to the right groin gave some relief.

In the course of the next few days little change occurred, but on the seventh day after the receipt of the injury, (May 27th,) the swelling over the track of the ball appeared more evident in the right groin, and was here observed for the first time to pulsate with each stroke of the heart. During the next two days, the swelling increased, although not very rapidly, and the pulsation became stronger.

On the evening of the tenth day, (May 30th,) Mr. Liston first saw the case. The patient's skin was blanched and waxy, and his pulse rather quick and feeble. He suffered at times severe pain in the limb, but there was no marked expression of anxiety in his countenance or manner; he felt his strength improving, and was hopeful as to the final result. The wound on the right hip was circular, filled with a dry depressed slough, with a narrow faint blush of redness round its margin; that in the left groin was a jagged line already partly closed by a thin cicatrix. There was extensive ecchymosis of the skin in both groins, and over the pubes, scrotum, and upper part of the right thigh.

In the right groin there was a large, oval, visibly pulsating tumor, extending transversely from about an inch and a half on the inner side of the anterior superior spinous process, to about opposite the linea alba; its lower margin projecting slightly over Poupart's ligament into the upper and inner part of the thigh. On handling, it appeared elastic but firm, very slightly tender, and not capable of any perceptible diminution in bulk by pressure. The pulsation was distinct in every part, and equally evident whether the fingers were pressed directly backwards, or whether they were placed at its upper and lower margins, and pressed towards the base of the tumor in a direction transversely to its long axis, the parts being for the time relaxed. The femoral artery was slightly covered by the swelling, and its pulsations were obscure in the upper third of the thigh. No pressure on this artery or on the abdominal aorta arrested the pulsation in the tumor, and pressure in the former situation was attended with severe pain. It was inferred that the tumor was a circumscribed false aneurism.

The question would now arise: Has the *femoral* artery been wounded?

If the wound from the pistol-ball had injured the femoral artery, so as to give rise to an instantaneons, rapid, and severe hemorrhage, there is the highest probability that Mr. Seton would have died on the field:—

A pulsation being felt on the distal side of the tumor was against there being a wound of any consequence in the femoral artery :—

For several days there had been no return of hemorrhage, and no tumor was visible, which could scarcely have been the case if the femoral or any important artery was wounded. If the wound throughout its whole length were sub-cutaneous, the femoral artery would in all probability be uninjured. The reports do not state that this circumstance was made out during life, although it turned out to be the case, on post-mortem examination.

The presumption was accordingly very strong, if indeed the certainty was not established, that the injured artery could not be the femoral.

But the following circumstances presented themselves to form a *prognosis*, from which it was inferred that the patient was in great if not imminent peril: The blood in the tumor appeared florid, the tumor pulsated very forcibly, the circulation was gradually being restored, and the effusion if left to itself would probably increase, as it had since its first appearance, although there was some doubt about this during the latter period;—"some thought it had been enlarged during the preceding night." An additional quantity of blood might be poured out at any moment. When the sloughs separated, renewed hemorrhage might occur, and the further loss of blood would in all probability prove fatal; or, the patient, weakened by its loss, would have to bear up against profuse sup-puration after the closure of the injured vessel by ligature or otherwise.

On the question of *treatment*, pressure either with or without the application of cold, was looked upon as quite insufficient to arrest even the further increase of the effusion, inasmuch as the bleeding vessel could not be more directly pressed upon than any other part, and as from the very form of the swelling, the compressing force would tend to drive the blood already extravasated further under the fascia of the abdomen.

The first indication, therefore, which presented itself was, to lay open the tumor, search for the wounded vessel, and tie it above and below the wounded point, but it was thought practicably to be unwarrantable; because—

1. Supposing the operator able to command the circulation on the proximal side, it must still be attended with a dangerous loss of blood.

2. As the supply of blood to the tumor could not, in this instance, be effectually interrupted by pressure on any large arterial trunk, the hemorrhage, in searching for the wounded vessel, would probably be unusually great.

3. Supposing that the common femoral artery should be found wounded, or one of its branches divided close to the main trunk, so as to render it necessary to apply two ligatures to the common femoral itself, the chances of the recurrence of secondary hemorrhage on the separation of the ligatures would be very great; con-

sidering the frequency with which this occurs in cases where the common femoral is secured by a single ligature, and in the most favorable position that the operator can select.

It was now, therefore, a question whether the external iliac artery should be tied. Against the performance of so formidable an operation the following reasons existed:—1. The patient's constitution: he was very fat, particularly considering his age; had lived very freely, taken little exercise for years, was delicate and impressible, and when indisposed, was always observed to be easily lowered by treatment. 2. The recent shock which the constitution had received; two such shocks within nine days must almost inevitably prove fatal. 3. The character of the operation; the extent of the wound would be a source of immense constitutional irritation in such a subject; the peritonitis which would supervene must be almost inevitably fatal,—the danger of mortification of the limb,—the unsuccessful result of large operations generally.

On the other hand, it was supposed that mortification of the limb was less likely to occur from there being little pressure on the femoral vein, and that the chances of peritonitis and mortification taken together, were less unfavorable than the chances of immediate and secondary hemorrhage attaching to the other operation. It was accordingly determined to tie the external iliac.

As to the time of performing the operation, the following circumstances existed in favor of delay. The further effusion of blood might never take place; if it did take place, it would not necessarily destroy life. No circumstance existed at the moment urgently demanding an operation. The delay would introduce no new element of danger, nature would either show a tendency to close the wound, or new symptoms would exhibit themselves; the patient might live a very considerable time without any interference, and an aneurism of this size and superficial situation might vanish without causing death.

The surgeons in attendance agreed, on the other hand, that any increase in the quantity or superficial extent of the extravasation must add materially to the difficulties of operating. They had previously agreed that an operation was necessary, and as the patient had rallied tolerably well, they considered that the sooner the supply of blood to the tumor was cut off by ligature the better chance the patient would have of life.

Operation by Mr. Liston the eleventh day after the injury, (May 31st, 9 A. M.) The patient having been placed on a table in a good light, an incision was made through the skin, commencing just above Poupart's ligament, rather nearer its outer than its inner termination, and continued upwards and a little outwards. A layer of from one and a half to two inches of sub-cutaneous fat, and the external oblique muscle, having been cut through by successive strokes of the scalpel, another thick layer of yellow lobular fat projected into the incision, hiding completely the internal oblique muscle, and looking at first somewhat like the omentum. This layer of fat, the internal oblique and the transversalis muscles, were then

cut through cautiously, and to a limited extent, until the thin transversalis fascia just appeared. This was readily torn through, and the finger being introduced beneath, it was lastly divided to the full extent of the external incision by means of a curved probe-ended bistoury carried along the finger as on a director. The sub-peritoneal cellular membrane thus exposed, proved to be so loaded with adipose tissue, and consequently so firm and solid, that it was easily separated from the face of the fascia iliaca; and for the same reason, the peritoneum and intestines were more readily and completely held aside than is usual in this operation. At the bottom of the deep wound thus formed was seen, first the iliacus muscle under the fascia, and then the psoas and the genito-crural nerve; but at first nothing was visible of the external iliac artery, nor could it be felt in its usual situation, close against the margin of the psoas. The fact was, that the vessel, adhering more closely to the sub-peritoneal cellular-tissue than to the other parts, was drawn with it slightly out of its course; and turning the ball of the finger inwards towards the cavity instead of towards the brim of the pelvis, its pulsations were felt distinctly. The external iliac was now a little more exposed, a common aneurism needle passed under it, and a strong twisted silk ligature carried round; but before this was tied, it was ascertained that when the vessel was pressed against the curve of the needle, the pulsation in the tumor was completely arrested. No return of pulsation took place in the tumor, but symptoms of peritonitis rapidly set in, and the patient died about thirty-five hours after the operation.

On post-mortem examination, it was found that the ball had passed altogether in the sub-cutaneous fat; that it did not pierce the fascia lata; and that the only vessel wounded, and forming the false aneurism, was a superficial branch of the femoral artery, which was divided close under Poupart's ligament, and nearly an inch from the main trunk, its divided extremity being perfectly open. The blood effused, and forming the main tumor was coagulated (forty-three hours after death.) There were several pints of sero-purulent fluid in the cavity of the peritoneum, and several "patches of inflammation" on parts of that membrane covering the large and small intestines, and the parietes of the abdomen near the wound made for the application of the ligature. This wound had a sloughy appearance, and was filled with a thin purulent discharge. The artery had been tied about the middle of its course, and was but little separated from the surrounding parts. There was no coagulum in it, either above or below the ligature. The vein was sound and healthy. There was a small abscess in the left groin, and a collection of blood in the cavity of the tunica vaginalis. The cord was not divided, but blood was extravasated in patches along its course.

Ligature on the External Iliac Artery for Aneurism.—Although from the rapid advance of operative surgery this ligature is now become a common affair, difficulties still attend it, and death often

ensues, as is seen in the above case of gun-shot wound by Mr. Liston. It is well to note that the artery has recently been tied successfully at the Royal Infirmary, Edinburgh, by Dr. Duncan, (*Northern Journ. of Medicine*, March, 1845,) and by the report at that time was doing well.

The patient was a man thirty years of age, an American sailor, of a stout robust frame, and full habit of body. The disease commenced in consequence of making a violent effort while reefing a sail, and was of some months' duration when he was admitted into the Royal Infirmary in Edinburgh, at which time the tumor was rapidly increasing in size. It measured six inches in length, and extended from about an inch above Poupart's ligament downwards. It was somewhat irregular in its surface, in consequence of some enlarged glands lying over it.

It felt pretty resisting at all points except over its upper and anterior parts, where it was more compressible and most prominent. It pulsated, when grasped, in all directions; but the pulsations were felt most distinctly over its upper and anterior part. Over the same part an indistinct bellows-murmur was heard, more particularly when the thigh was flexed on the abdomen. When the limb was extended so as to make the fascia tense, the tumor diminished somewhat in size; and a certain diminution could be effected by pressure, and likewise by compressing the abdominal aorta so as to suspend the pulsation in the swelling. The integuments over the tumor were free from discoloration, were perfectly lax, and could be moved freely over it. There was no œdema of the limbs, and no congestion of the superficial veins. After the requisite preliminary antiphlogistic treatment had been practised, the vessel was tied. The patient was laid resting rather on his left side, with the shoulders slightly elevated and the limb somewhat bent. An incision dividing the skin and superficial fascia was made, commencing about an inch above the middle of Poupart's ligament, and carried upwards for about three and a half inches, in such a direction as to be, when it passed the anterior superior spinous process, about an inch or more internal to it. It was slightly curved, the concavity being towards the mesial line. The aponeurotic expansions of the external oblique, the internal oblique, and transversalis were divided to the same extent. The fascia transversalis was next divided to the requisite extent, the peritoneum carried inwards, and the vessel exposed.

The thin fascia covering the artery was divided to a very slight extent, and the needle carried around the artery, with its convexity towards the peritoneum, counter-pressure being made with the forefinger of the left hand. As a small filament of a nerve lay over the needle along with the artery, another needle was passed from within outwards, the first being retained to serve as a guide. The vessel was then compressed over the needle, and immediately the pulsation in the tumor ceased. The ligature was secured, one end being cut close to the knot. The securing the ligature was fol-

lowed by immediate cessation of the pulsations, and collapse, to a certain extent of the tumor. The wound was brought together by several points of suture, and lint, wetted with cold water, applied. The patient was laid in bed, with the limb slightly bent, and supported by pillows at the knee. The patient scarcely had a bad symptom afterwards, except that some excitement was caused by a crowd of students around his bed at the visit the day after the operation, which was removed by an opiate antimonial draught. He was also bled from the arm the same evening. The ligature came away on the twenty-second day.

A serious objection to a ligature upon any of the great arterial trunks, if it were well established, would be the so-called *white ramollissement* or softening of the brain, alleged to be an occasional consequence of a ligature upon the carotid. Dr. Todd (*Medico-Chirurgical Transactions*, Vol. XXVII.) gives in illustration a lesion of this kind from obliteration of the right carotid caused by a dissecting aneurism of the aorta. He makes it appear that the lesion is quite analagous to that of *senile gangrene*. Paralysis of the left side was produced in the case of Dr. Todd, from, as he supposes, the obliteration mentioned. The entire right hemisphere of the brain was found anæmic or in the state of white softening.

General Principles of Treatment in Aneurisms of the Aorta.—Though we cannot by any means subscribe even to the qualified approval given by Dr. Norman Chevers (See RANKING'S HALF-YEARLY ABSTRACT OF THE MEDICAL SCIENCES, Vol. II., American edition, New York, 1846, Langleys, Publishers, New York, p. 39—40; See also *London Medical Gazette*, Aug. 29, 1845) to Val-salva's treatment, we have had ample means of knowing that nothing can be more true, rational and effective, than the following sound, and for the most part new, views as given by Dr. Chevers for the relief or even cure of *aortal dilatations*, where the structural disorganization from the continuance of the disease or age of the patient probably have not advanced too far, and where the disease may be deemed secondary, or symptomatic of irregular life, improper diet, &c.

Dr. Chevers says, (Ranking, *Ib.*, p. 39 :)

The natural process by which the cure of an aneurism is effected, is, by procuring obliteration of the sac by layers of firm coagula. In aneurisms of the extremities this alone appears to be sufficient, but in aneurisms of the aorta, a far more delicate process requires to be effected, as here the sudden formation of loose coagula will always be liable to occasion rupture of the walls of the sac. "It is necessary in aneurism of this artery," says the author, "to cause the obliteration of the sac, by layers of coagulum firm enough to resist infiltration of blood, and which shall present internally a smooth surface over which the blood may readily glide."

Another object in the treatment, much insisted upon by the author, is that of removing visceral congestions, and avoiding all unnecessary irritation and excited action in the organs, at the same

time endeavoring to keep up a natural discharge of their functions. The two organs which it is especially necessary thus to attend to, are the liver and kidneys. Many cases of disease of the heart and great vessels would be readily enough kept in abeyance, were they not aggravated by consentaneous inactivity or irritation of these two great emunctories.

In aneurism, as in every other form of organic disease of the vascular centres, the prolongation of life generally, in a very great measure, depends upon the maintenance of that degree of rest which, while it prevents the capillary obstruction which is attendant upon muscular action, does not deprive the patient of the benefits of the air and gentle exercise.

The reduction of the volume of the circulating fluids has always been considered a main point in the treatment of organic diseases of the heart and its appendages, but "unfortunately," observes the author, "depletion has been too often the course adopted, to effect this purpose." The desired effect, however, may be far more successfully produced by gradually diminishing the fluid ingesta, than by any system of active evacuation; and the fact, that the palpitation, lividity of the surface, &c., mainly depend upon the admission of an undue quantity of material into the blood, becomes itself a suggestive that in such cases, all unnecessary articles of diet, solid as well as fluid, should be dispensed with.

The author animadverts with severity upon the practice of exhibiting digitalis, and other medicines which have a depressing effect upon the power of the heart. The great error, he observes, is in regarding the palpitation, for which these medicines are generally given, as though it were itself the disease, and not what it really is, the sole means by which an overloaded and obstructed heart is enabled to propel its contents. The rational mode of treatment is clearly to remove the causes of the obstruction from which the heart suffers, where these are not of a permanent nature; or if this be not possible, to diminish the load of fluid which embarrasses the heart when the palpitation being no longer requisite, will cease of itself. It is certainly unwise to administer a medicine which its advocates justly term a "direct sedative of the heart" in a class of diseases, where all the worst symptoms arise from the difficulty that organ experiences in propelling its contents.

Whenever, as frequently happens, the patient appears to be gradually sinking from the violence of the paroxysms which attend the failure of the heart's powers, restoratives, or even powerful stimulants, become necessary.

Venous Pulse.—In the larger venous trunks it is familiarly known in surgical operations about the neck, that a *reflux pulsation* is frequently communicated to them from the heart, but in the smaller veins we know of no other fact of venous pulsation, except the following, recently recorded. (See Ranking's *Half-Yearly Abstract*, &c., American edition, New-York, 1845, Vol. I., p. 256—7.)

M. Martin Solon, in a memoir read before the *Academy of Scien-*

ces, Paris. (*Lancet*, Jan. 4, 1845, and *Bulletin des Académies*, Novembre, 1844, p. 24,) has given the details of two cases in which he observed pulsation of the dorsal veins of the hands. The patients had both been repeatedly bled, and taken tartar-emetic, for an attack of pleuro-pneumonia. The veins were prominent, rounded, of a blueish-red color, and presented a diastolic and systolic movement, easily appreciable by the eye, and synchronous with the pulse: it was evidently not communicated by any adjacent vessels. Upon pressing the fingers, the pulsation ceased; but when the wrists were pressed, they remained as before. When the brachial artery was pressed, the pulsations of the radial and ulnar arteries, and of the dorsal veins of the hand, all disappeared together. In both cases, the patients gradually recovered. In one the venous pulsation appeared on the fifteenth day and remained seven days, the cardiac impulse being strong: in the other, the heart's impulse was feeble, and the venous pulsation remained for a shorter time. M. Solon explained the phenomenon of venous pulsation in these cases, by supposing that the abnormal fluidity of the blood facilitated its passage through the capillaries, and thus enabled it to retain the impulse communicated by the heart. He alluded to similar cases by Dr. Graves and Dr. Ward, (*Lond. Med. Gaz.*, 1832, p. 376. Dr. Ward accounted for the phenomenon of venous pulsation in the way above suggested by M. Solon.) Pathologically, he thought the phenomenon important, as indicating a state of fluidity of the blood, which would render further bleeding inadvisable. Physiologically, it was important, as proving that the entire circulation is under the influence of the heart. In a discussion which ensued after the reading of the memoir, M. Poiseuille agreed with M. Solon in considering the phenomenon as another proof of the influence of the heart over venous circulation, but could not attribute it to the greater fluidity of the blood, for the experiments of Magendie and himself had proved that the more aqueous the blood became, the greater was the difficulty with which it passed through the capillaries, owing to imbibition. He thought it, therefore, more correct to explain the influence which loss of blood evidently had in producing venous pulsation, by considering the heart as having lost energy, whereby a smaller quantity of blood is thrown into the arteries, which being less dilated, contract with less force, and thus lose their power of converting the intermittent fluid into a continuous one, as is normally the case.

Tetanus cured by Alcoholic Drinks, in inebriating Doses.—A treatment for tetanus, at war with the movement in favor of teetotalism, is proposed by Mr. Stapleton, (*London Lancet*, March 22, 1845,) viz., ardent spirits in intoxicating doses, which in one case succeeded in entirely suspending the tetanic symptoms, but without saving the life of the patient. Another case was wholly cured of this too often fatal disease, (See paper by Dr. Wilson describing a case attended by Mr. Ilott, sitting of the *Medico-Chirurgical Society* of London, April 22, 1845,) by the exhibition of brandy in enormous doses, opium being at the same time studiously avoided.

During the space of eight days the patient took as much as *two gallons of brandy*, in addition to *wine*, &c.

The acknowledged fact that most fatal cases from tetanus, (and most of them unfortunately are fatal,) die in a state of *asthenia*, appears to justify this last-mentioned treatment.

We have thought it proper to allude to the above subject, from *tetanus* being almost exclusively one of the consequences of surgical operations, or of wounds requiring surgical treatment, (see text of this Vol.) We may also add in relation to the use of alcoholic drinks in a medicinal point of view, that in the ravages of *Asiatic cholera*, at London, Paris, and also in this country, the steady use of moderate potations of pure brandy at certain intervals of the 24 hours, and use of animal, and avoidance of most kinds of vegetable food, was deemed the surest preventive and protector against an attack of the disease. The same has been observed in our prevalences of the West India pestilence to Northern men, known as *yellow fever*.

DR. MOTT'S LAST CASE OF EXSECTION OF THE LOWER JAW FOR OSTEO-SARCOMA.

Case of Exsection of Part of the Lower Jaw for Osteo-Sarcoma, at Newark, New-Jersey. By DR. MOTT, Thursday, Dec. 26, 1844. (Drawn up by P. S. Townsend, M. D.)

The patient H——, was aged about 35. This was a genuine case of the malignant disease known as osteo-sarcoma, but confined almost exclusively to the *alveolar* processes on the left side of the lower jaw, which was the part exsected.

The patient was of rather tall, slender make, pale and thin—with dark hair—and of nervo-bilious temperament. About two years or eighteen months before, during a quarrel, he had received a severe blow directly on this part of his jaw, from a man who knocked him down. About a year ago, the gums over this portion outside began to show a spongy livid appearance from the alveolar process, and its periosteum beneath having become previously inflamed and swollen. The tumor pushed the cheek out in this part, and its size was that of a pigeon's egg. The *warty bed of long fungoid shoots, or vegetations*, on the side of the gum in front, had a very peculiar appearance, being generally about a third to a half an inch in length, and in some places loose with fissures, separating them down to their roots, allowing of an opportunity when these roots were held apart, to notice the carious fetid portions of the alveoli, which were not yet wholly destroyed. Such however, had been the devastation within a year, that the three or four teeth which corresponded to this part were so loose that they could easily be moved with the finger, and of course as readily taken out. The surgeon, (Drs. Darcey, Pennington, Campfield, &c., of Newark, being also present,) commenced his curvilinear incision at his usual place in front of the meatus auditorius externus, and brought it

down outside and under the angle and base of the jaw close to the latter, till coming to near the symphysis of the chin, he terminated the division below the border of the lower lip. The upper border of the wound, and sufficient of the lower being dissected off to insulate the jaw and its tumor and tissues, and two or three vessels tied in the course of this dissection, the *chain-saw* was passed by a sharp thick probe, first behind the front part of the jaw, and that portion sawed perpendicularly from below upwards—not however, without some difficulty from the saw becoming pinched in the bone. In a few minutes after the same saw was introduced in the same manner, a little behind the angle of the jaw, and that portion sawed obliquely upward and forward—the last cut of the saw reaching up to near the fungoid tumor—but evidently outside of the degenerate structure, as the fresh, wholesome surface of the sawed bone showed.

The *diseased portion* was thus completely isolated and exsected, being about 3 inches in extent along the base of the jaw, and less above. After waiting a while for any bleeding from the small vessels to cease, and tying such of the vessels that required it—the flap was brought down, and the ligatures and straps applied in the usual manner.

The patient showed much moral courage as well as physical force for one so thin, pale, and apparently delicate in frame, as he sat up in a common chair, his head only supported behind, during the whole operation. The hemorrhage for a temperament like this was considerable, but not important, and there was not the least syncope or collapse,—the pulse being almost unchanged by the operation.

Feb. 26, 1845.—Having read over on this date the above sketch to Dr. Mott, he said the patient had long since gone home quite recovered.

In alluding to the cauliflower appearance that the soft parts or gum in this patient exhibited, Dr. Mott said that it possessed somewhat more of the fungoid character than most cases of osteo-sarcoma.

Exsection of half the Lower Jaw for an Osteo-Sarcomatous Tumor—also Disarticulation of the Jaw and Previous Ligature on the Primitive Carotid Trunk, by John P. Batchelder of Utica, State of New York.—After all that has been done by American surgeons cotemporaneously with foreign practitioners, to exalt *pari passu*, the science of surgery, and after all that this science owes for many of its important results to the high standing generally of medical institutions and the medical profession in this country, there is much that some of our surgeons have culpably neglected to make public, which requires yet to be rescued from oblivion. We therefore make with pleasure the following summary from a private communication just received from an estimable practical surgeon, Dr. Batchelder of Utica.

The operation for the removal of an *osteo-sarcomatous tumor involving the inferior maxillary bone*, about two inches of which, with

the tumor, was excised, was performed on the 16th of June, 1825, at Deerfield, Mass., by Dr. J. P. Batchelder, now of the city of Utica, N. Y., the *carotid artery* on the affected side having been ligated the day previous. It is believed that this operation is the *first of the kind ever performed in the New England States*. Although the whole morbid mass appeared to have been extirpated, the disease returned, and on the 19th of November following another operation was instituted by which *one-half of the lower jaw with the whole of the tumor* constituting the disease, was removed by sawing through the former, at or near the symphysis, and *disarticulating the condyloid process* from the glenoid cavity in the temporal bone. The operation for the excision of one-half of the inferior maxilla for the cure of this most formidable disease, was performed in the first instance by our distinguished countryman, Prof. Mott, with whom it was original, and in the second by Dr. Batchelder as above stated. The patient, Mr. Spenceer Hubbard of Deerfield, very soon recovered from the operation, and continued sound some six or seven years, when the disease returned and ultimately destroyed him.

We avail ourselves of another interesting surgical fact, which would fall under *Exsections* in this work, and which has just been contributed to surgery by the practitioner above mentioned. We find it recorded [correctly as the surgeon himself has informed us] in the *New York Medical and Surgical Reporter*, edited by Clarkson T. Collins, M. D., &c., Vol. I., No. 7, Saturday, Jan. 10, 1846, p. 113—115.

REMOVAL OF THE HEAD OF THE FEMUR.

This important operation was performed by J. P. Batchelder, M. D., of Utica, N. Y., during the past summer, and we are indebted to a friend for the following particulars of the case, which, if incorrect in any particular, we beg will be corrected when the operator shall have seen this article. The subject of the operation was a young man, about twenty years of age,—he received an injury at the hip-joint, from the kick of a horse, some four or five years previously, and had not been able to use the leg from that time, up to that of the operation. The limb had become somewhat atrophied, and was about two inches shorter than its fellow. There were two fistulous openings which kept up a continual discharge, and consequently his general health had become very materially impaired. The above alluded to, fistulous openings were situated between the trochanter major and the tuberosity of the ischium, one above the other, and about three inches apart. Upon introducing a probe at either of the sinous openings, a bone was felt, which was supposed to be the head of the femur necrosed; but whether it was detached or not could not be determined.—The dead bone which lay in the direction of the acetabulum was about three inches from the surface, owing to the tumefied condition of the soft parts. The surgeon at first proposed to make an incision down to the bone, and

extract it, but owing to the patient's state of general health, it was concluded to adopt a slower and equally certain, and perhaps safer mode; which was to introduce tents of compressed sponge, for the purpose of dilating the openings; the *spongia præparata* being inserted every night and morning, *pro re nata*, and gradually enlarging the quantity. In the course of ten days the openings were considerably enlarged, in consequence of which, by the use of the probe, it was fully ascertained that the head of the bone was detached. The surgeon then introduced an eyed probe, very much curved, and armed with a ligature, attached to which was a cord of about one-tenth of an inch in diameter; he succeeded in passing the curved probe in at the lower opening, and along the bone, until it could be felt at the bottom of the one uppermost, when it was seized with a strong dressing forceps, and after some trouble, but without much pain, drawn out through that aperture and the ligature tied with a slip-knot over the intervening flesh, so as to be tightened daily, which was continued for about a fortnight, when having completely effected the object for which it was employed, it dropped off. On passing the finger deep into the chasm, the bone could be distinctly felt, and was ascertained to be slightly movable. A further and more particular exploration was now made, and the scoop end of a strong director hitched under one of its edges, by means of which it was slightly raised, which enabled the Doctor to grasp it with the forceps, and by turning it still more up, he finally succeeded in bringing it out edgewise through the external wound. The bone taken away, proved to be the *head of the femur*.

The wound was dressed by introducing a fold of lint between the lips of the wound, passing it to the bottom of the cavity, and over this a compress and bandage applied. In the course of a few weeks, the entire wound was healed, with the exception of a small opening, which appeared to be about half an inch deep, over which he applied small blisters in succession, by means of which, and the use of *R. Tr. canth.* and tonics, it was soon completely healed. [Dr. Batchelder informs me that he has always found the internal administration of cantharides eminently serviceable in his surgical practice, in rapidly promoting granulations. Take this tonic effect in connection with the tendency or *metastasis* to *cystitis*, *abscess of the liver*, &c., after surgical operations, and the vicarious functions of the kidneys and liver. See on this subject our note towards the conclusion of the volume. Dr. Batchelder gives the cantharides until slight strangury is produced. T.] His general health rapidly improved under a constitutional treatment, until he was discharged, completely cured.

In three months after the removal of the bone, he laid aside his crutches, and by the help of a cork-soled shoe, walked short distances quite easily, and somewhat gracefully.

It may be said by some, that the *knife* would have been preferable to the slower means used, but it was adopted upon the golden rule, "do unto others as we would wish to be done by,"—a principle which should always govern us in surgery, as well as in

morals. Dr. B. is a gentleman of experience in his profession, having occupied the chair of surgery in one of our Medical Colleges many years since, but latterly he has been engaged in private practice only.

We are informed that the Doctor has been in the habit of making great use of the sponge tent, and compressed sponge, in various affections of the bones, such as necrosis, and particularly caries, for more than thirty years past.

By the tent, a passage may be made without pain to the parts, to which pieces of compressed sponge may be applied daily, until all the morbid parts are absorbed, when the practice should be discontinued, and the sores, ulcers or fistulas, allowed to heal. Many other intractable morbid growths, even of a malignant nature, may be successfully treated in the same manner.

What must have been the condition of the hip-joint from the time of the injury up to the time of the operation? Was the neck of the bone fractured and dislocated at the same time, by the kick from the horse, some years previously? Or was the neck of the bone merely fractured, and the head left remaining in the socket, and acting as an irritant, causing the cotyloid ligament to be absorbed, thus freeing itself from the acetabulum? Or could it be that there was morbus coxarius caused by the injury, and followed by necrosis of the head of the bone? Our informant has not given us enough of the early history of the case, in order to decide an important question.

The operation for removing the superior extremity of the femur, for hip-disease, has been performed twice in England, which was unknown to Dr. Batchelder, at the time of his operation; hence, the operation was original with him.

The *os coccygis* has been recently extirpated by Dr. Nott, an American surgeon, (See Amer. Journ. of the Med. Sciences,) in a lady, aged 25, for severe neuralgia—a diagnosis of the condition of the spine indicating extreme tenderness over that bone. The incision was made down to the bone two inches in length vertically upwards from the point; the bone was then disarticulated at its second joint, the muscular and ligamentous attachments divided, and the two terminating bones dissected out without much difficulty. The last one was found carious, hollowed out to a mere shell, and the nerves exquisitely sensitive. The operation, though short, was attended with extreme suffering, and the pain afterwards violent for hours, coming on every ten or fifteen minutes, and accompanied with a sensation of *bearing down* like labor pains. At the end of a month, all medicaments proving of no avail, the pains subsided, the wound healed, and the general health was much improved. At the next catamenial period, she suffered severe pains and tenderness in the vagina, which were ultimately effectually cured by *citrate of iron* in five-grain doses three times a day.

Fracture of the Totality of the Spine of the Scapula by Muscular Action.—Dr. Heylen (*Anal. de la Soc. Méd. d'Anvers*, and *Jour. de Chirurgie*, Paris, Mai, 1845; see also Ranking's *Half-Yearly Ab-*

stract, &c., Amer. ed., vol. II., New York, 1846, p. 88-9) furnishes an interesting case where the whole body, as it may be called, of the spine of the scapula, is supposed to have been fractured at its base by the mere force of holding on with the arm to a cart which the horse had run away with. The diagnosis of distinct crepitation at the middle portion of the crest of the spine was made by holding the clavicle and the coracoid process firm, while the arm was being rotated. There was no ecchymosis, and none of the usual signs of fracture of the acromion. The fractured fragments seemed to have been held naturally in place by the muscles of the shoulder, and the head of the humerus in its cavity, there being no injury to these last.

For a better *diagnosis of fractures of the neck of the femur*, M. Lionet proposes, (*Gaz. des Hôpitaux*, Paris, June, 1845,) in order more distinctly to hear the crepitation, to let the patient stand his whole weight on the sound limb while the other hangs down free, and the ear or stethoscope is applied to the joint. M. Vidal justly approves of this as better than auscultation in the longitudinal position.

On the Position to be maintained in the Treatment of Diseases of the Hip Joint in the Young.—In diseases of such growing importance in the increasing luxuriousness of the present age, as those of the hip-joint, and where, as we have seen in several recent instances, so much and even such diametric discordance among the highest known surgical authorities, as to their true diagnostic marks, and wherein a simple *morbus coxarius* according as it had been long supposed to be understood, differs from carious and other affections outside of the head of the femur and cotyloid border of the bone, it is advisable to record as soon as it can be procured, for the benefit of the profession, all that can throw any new light upon these subjects. We are satisfied, therefore, that we should notice here immediately the latest opinions of so esteemed an authority in surgery as Mr. Aston Key, of London, from whose paper (see *London Med. Gazette*, Oct. 24, 1845; also *Ranking's Half-Yearly Abstract*, &c., Amer. ed., vol. II., 1846, p. 111-13) recently laid before the Physical Society of Guy's Hospital, London, we extract the following observations:—

The insidious progress of strumous disease of the hip-joint, the division of the disease into its several stages, and its usual termination in a greater or less degree of ankylosis of the joint, are, I presume, so well known that I shall forbear to enter minutely into the pathology of the disease; my object in these remarks is to point out the inconvenience of the deformity that is almost always found to attend convalescence, the causes which give rise to it, and the best mode of preventing it.

The first change usually observed in the relative length of the two limbs, is the temporary elongation or shortening of the one affected, according to the position which the patient maintains in the act of progression in the early stage of the disease, when it is characterized rather by a sense of weakness than actual pain. In the commencement of the affection, the patient throws the weight

of the body instinctively upon the sound limb, and merely steadies or balances himself upon the unsound one. If the foot be carried forward and placed flat on the ground, the same side of the pelvis is carried forward and drops, giving a lengthened appearance to the limb. If, on the other hand, the unsound limb is not advanced much in progression, and the patient rests on his toes, the pelvis is carried upward on that side, and the limb appears to be shortened. Both these states are usually only temporary, and disappear if the patient is prevented from walking, and is made to lie down.

To those who have had much experience of this affection it is almost needless to remark, how rarely it is seen in the early stage, at a period when properly applied remedies can restore the joint to its previously healthy state. The insidious nature of the attack disposes both medical men and parents, alike unsuspecting of its real nature, to regard the affection as one merely of weakness, until unequivocal symptoms evince the commencing disorganization of the articular cavity.

The second stage of this disease is no longer, as the first has been, one of erythema of the synovial lining of the joint, but assumes a more active form of inflammation, extending to the more dense parts of the capsule and cartilage, and is attended with severe pain in rotation and abduction of the limb. Often, in the earliest part of the second stage, the limb will not admit of perfect extension, and by careful examination of the joint it may be discovered that the thigh is permanently flexed upon the pelvis. It is this state of the limb to which I wish to direct your attention, as fraught with the worst consequences to the patient.

This state of flexion of the femur on the pelvis usually takes place slowly and imperceptibly, but sometimes it is rapidly induced by a sudden attack of inflammation in a joint which has previously exhibited signs of disease in its mildest form. This is the worst form of the disease, so far as deformity of the joint is concerned, for the intense pain which the patient experiences on the slightest movement of the limb, induces him to seek for ease in positions that add greatly to the distortion of the limb, by the obliquity given to the pelvis. The patient is seen lying usually on the sound side, with the affected limb drawn up to nearly a right angle with the pelvis; as the patient lies on his side, the affected limb appears to be three or four inches shorter than the other. When he is placed on the back—a position assumed with difficulty—and the bearings of the two patellæ and the spinous processes of the ilia are noticed, the former are seen to differ as much as from two to three inches, while only a difference of an inch is perceptible in the level of the latter. This would seem to show that the limb is actually shortened; such, however, is not the case, but by examination of the pelvis it will be seen that the twist of the pelvis on the lumbar vertebræ, by carrying the affected joint backwards, is the cause of the great shortening of the limb.

During the stage of inflammation it is impossible to use any means for counteracting this disordered condition of the pelvis; and by the time that the patient is able to bear extension, so as to re-

store the pelvis to its natural bearings, and to diminish the angle which the femur makes with it, the parts have become so fixed in their new position as to render it difficult of alteration, and impossible in the majority of cases to restore them to their natural bearings. The consequence is, that when the patient is convalescent with a somewhat stiffened joint, the foot cannot be brought down to the ground, and a shoe with a sole of two inches is required to enable him to walk with the foot flat on the ground.

How is this state of things to be prevented? The only remedy for the evil is, in every case of hip-joint disease, to maintain the straight position as soon as the nature of the affection is ascertained, which is a position applicable in all stages of the disease.

In the early stage, characterized by only a slight limping in the gait, or by an occasional slight pain in the knee or thigh, it possesses the advantage of maintaining the joint in a state of complete repose. The articulation being at rest, the muscles do not act, but remain in a passive state. On the contrary, when the limb is kept bent, with a pillow placed under the knee, a position usually resorted to in the early stage of the disease, the pelvis and thigh of a child are continually in motion; little or no pain is felt by the patient, and injunctions to preserve rest are made in vain. In the bent position, therefore, rest one of the most important elements in treating a diseased joint, is not maintained, and the disease therefore fails often to be arrested. By a long splint applied along the outer side of the limb and made to extend from the toe to the axilla, entire rest is given to the joint, and absolute inaction of the muscles preserved. I believe from what I have seen of this stage of the affection, that the arrest of the disease is greatly expedited by the entire tranquillity which is obtained by the straight position in conjunction with the mercurial treatment.

The principal advantage of preserving the limb in a straight position is seen in the second stage of the disease, when under the united effects of inflammation and ulceration of the cartilage of the joint, the tendency of the flexor muscles to contract induces such a degree of deformity in the lumbar vertebræ, pelvis and hip-joint, as when once allowed to take place, can never afterwards be wholly remedied. The position on the back is not irksome to the patient, nor painful, but is borne with cheerfulness and without complaint, because, in the movements which the body undergoes, the diseased joint is kept at rest.

The course which abscess follows when suppuration takes place in the joint, seems to be in some degree modified by the straight position. When the limb is allowed to bend upon the pelvis, matter is usually formed at the back part of the joint under the glutæi muscles, or at the side of the joint on the anterior margin of the glutæus medius. But when the straight position is observed, the suppurative action is inclined to the forepart of the joint, and the collection of fluid is formed on the outer edge of the iliacus muscle, on the side of the tensor vaginæ femoris. This course of the matter may be accidental; but in two cases, now in Guy's Hospital, sup-

puration has taken this course, one having burst and so discharged itself; and in the other case the abscess is making its way towards the surface in the same direction. I know of no inconvenience attending this course of the abscess; it is easily managed, or perhaps more so than when it occurs on the posterior aspect of the joint. But there is an advantage gained in the advanced stage of the disease, too important to be passed over; viz., the prevention of dislocation of the head of the bone on to the dorsum ilii; an occurrence, though by no means frequent, yet found sometimes to take place, and greatly adding to the deformity and shortening of the limb. It can occur only in the flexed position of the limb, which thrusts the head of the bone backward against the capsular ligament and posterior part of the acetabulum; and these structures, together with the head of the bone, being partly destroyed by the ulcerative process, the head gradually escapes from the cotyloid cavity, and becomes looped upon the dorsum of the ilium.

The state of ankylosis in which this disease usually leaves the joint, requires a concluding observation. In reply to any objection which might be raised to the utility of a limb ankylosed in a straight line with the body, the only inconvenience arising from it occurs in the sitting position in which the patient, being unable to flex the limb sufficiently to sit on a chair in the usual manner, is compelled to drop the affected limb in a nearly perpendicular posture, and to sit with the pelvis resting on the side of the chair. This is the only evil attending the straight position, and is more than counterbalanced by the uniform length of the two limbs, and the absence of almost all lameness in the act of progression.

Care, however, should be taken to prevent the patient bearing too early upon the unsound limb during convalescence, when the straight position has been observed in the treatment of the case; for a sense of weakness, as in the first stage of the disease, induces him to raise the pelvis on that side, in order to prevent much weight being thrown upon the weak limb. The effect of this elevation of the ilium is to curve the lumbar vertebræ in a lateral direction, and this distortion becomes permanent.

Rupture of the Tendon of the Triceps Cruralis on both sides.—The *Gazette des Hôpitaux* of Paris, for June 14th, 1845, (see also *Ranking's Half-Yearly Abstract*, Amer. edition, Vol. II., p. 95,) makes a judicious reference to ruptures of the muscle in question, and with which, and the recent curious facts reported thereon, it may be serviceable for the student to refresh his memory.

But few examples of a rupture of this strong tendon have been recorded, more especially of its occurrence in both limbs. In two cases cited by Ruysch, the accident was produced by the patients falling upon their knees, the legs being violently flexed on the thighs. In a case by J. L. Petit, the rupture occurred in attempting to jump a ditch. In another case it is said to have been produced by falling upon the knee in descending a ladder, and that the fall on the knee produced the rupture; but when the knee struck the ground, the rupture must have already taken place, or it could not then have

happened—the ground necessarily limiting the extension. In a case by Sancerotti, a heavy subject slid down the sides of a ladder, and fell with his two legs folded under him; he partially ruptured the tendon of the patella in the left leg, and completely in the right leg. In a case by Boyer, the patient lost his equilibrium while skating, and was in danger of falling backwards; in the effort made to throw his body forwards, he broke the tendon of the extensor muscle of the right leg. In a case by Dupuytren, in consequence of a sudden and violent curve of the trunk backwards—in one case by drawing the foot out of a hole,—in another by wrestling,—in another by falling forwards from a ladder: and in various other ways this accident is said to have occurred. In a case lately treated in the Hôtel Dieu, at Paris, under M. Roux, the accident occurred to a young man descending a ladder. He had high-heeled boots. Being caught in one of the steps of the ladder by his heel, he instinctively threw himself backwards to prevent his body falling forwards, and in this violent effort the ligament of the patella was ruptured in both legs. He distinctly heard a snap on the right but not on the left side.

“It is during the contraction of the muscle on which it depends,” remarks Delpech, “that a tendon may be ruptured. It appears to the contrary, that it is during the action of their antagonists, or of a new force opposed, that muscles are torn.” (*Maladies reportées Chirurgicales*, t. I., p. 184, et seq.) M. Malgaigne also maintains that “when a sudden force tends to elongate the muscles at the period of a powerful contraction, the tendon snaps. The rupture of a muscle takes place only when the muscle is stretched or elongated, the rupture of a tendon only when the muscle is contracted and shortened.”

This appears to be the surgical doctrine, but in the above case the triceps cruralis could not be contracted while the trunk was powerfully curved backwards to prevent a fall forwards, and the same remark may be made respecting Sancerotti's case, who fell with the triceps extended to the uttermost. It was, also, while throwing himself backwards to avoid a fall forwards, that Dupuytren's patient ruptured the tendon in question. In some of the cases, it appears that Delpech's doctrine holds good, as in Boyer's case above referred to, although it is difficult to understand the rupture taking place at the fixed point, since to maintain the position of the trunk, the muscle must have had its fixed point below, and we should rather expect the accident would take place at its superior insertion, that is to say, at the point of resistance.

The case was treated by placing the two limbs extended on a plane inclined from the feet to the pelvis, and maintaining them with a posterior splint and bandage in a state of permanent extension. The accident cannot be regarded as trivial, since, of fourteen cases referred to in a memoir by Demarquay, five only were understood as having had a completely favorable result.

A case of a gentleman who stumbled and ruptured the *rectus femoris*, is related by Mr. Grantham, (*London Lancet*, Oct. 1844.

The muscle was greatly swollen, and drawn *one-third* up the thigh with a *corresponding* depression above the patella. Mr. Grantham thinks the rupture may have been near the muscular bands, as there was no disposition to the deposition of an intervening ligamentous tissue, and nothing effected by position or pressure. This case militates *against* a proposition to divide the tendo Achillis in talipes near its fleshy part.

A rare dislocation, that of the *Head of the Tibia upwards and forwards*, has recently been well described by Dr. Hutton, of Dublin, (*Dublin Journal*, July, 1845, p. 487; also Ranking, &c., Vol. II., p. 89-90,) the surgeon whom we have had occasion in our notes under arteries, to speak of with so much commendation, as the one who a few years since revived, by a new and effectual process, the cure of aneurisms by compression, a mode which has proved in his hands, and those of other surgeons of Dublin more especially, a brilliant triumph for conservative surgery. The case of luxation in question, is as follows:—

Anne Byrne, a healthy woman, æt. 35 years, admitted into the Richmond Hospital, June 21st, 1845, states that she was carrying a heavy load of metal on her back, when her right heel slid forwards rapidly, the knee at the same time being directed inwards with a twisting motion: she fell to the ground, from which she was unable to rise; was immediately carried to the hospital, where the following observations were made by Dr. Hutton, under whose care she was admitted. The limb lay extended, and was an inch and a half shorter than the other; the foot was inverted, but not fixed in that position; the patella was pushed upwards, its inferior border being directed forwards, and its posterior surface downwards, resting on the articulating surface of the tibia: this could be distinctly felt when the patella was pressed to one side, which it was very easy to effect. A transverse sulcus bounded the patella superiorly. The anterior surface of the thigh was on a plane considerably behind that of the leg, which was twisted a little inwards; the condyles of the femur were distinctly felt posteriorly, particularly the outline of the external condyle; there was great laxity of the articulation, and lateral motion was easily produced to a considerable extent, particularly in an outward direction; the muscles on the anterior part of the thigh were quite relaxed, and the ham-string muscles could not have been tense as the limb lay extended, and there was little resistance to extension in a right line, so that the dislocation was reduced in a few seconds; the fibula maintained its connections with the tibia; there was no numbness of the leg, but the pulsation of the anterior tibial artery could not be felt; it was, however, not very distinct in the uninjured limb. This accident seems to be of rare occurrence, and the symptoms of the luxation are not fully described, either by Sir Astley Cooper or Boyer, probably because the injury was deemed by them easy of recognition, and yet the description of this luxation, in the *Dictionnaire de Médecine*, is taken from an unreduced case, mistaken or overlooked by the attending surgeon. In this

luxation, Boyer expresses his opinion that the lateral ligaments must be torn as well as the crueial and posterior ligaments of the joint; but in the case here related, lateral motion could not be communicated after the dislocation was reduced, which seems to prove that they could not have been ruptured, nor even stretched to any great extent. Some variety, however, is to be expected in injuries of this nature, according to the degree of force applied, its direction, and other circumstances.

The rare occurrence of dislocation of the *tibia forwards*, induces us to mention another recent case at the hospital of Metz, as related by Dr. F. Jaequot, of St. Die, (*Arch. Gén.*, April, 1845, p. 475. Also Ranking's *Half Yearly Abstract*, Am. ed., New-York, 1845, vol. I., p. 144,) in which a military sergeant, aged 21. of robust habit, making a long jump (four yards) on a flat surface, fell on the left foot, the leg being extended and directed backwards, whilst the right leg, being in advance, did not reach the ground. He experienced violent pain and fell forward upon his belly. A dislocation of the tibia forward had occurred, which Dr. Jaequot considers it impossible, when recent, to confound with any other lesion.

The thigh formed an obtuse angle with the femoro-tibial articulation, so that the axis of the leg was placed considerably in advance of the axis of the thigh. The superior surface of the tibia was covered by the patella, the sub-cutaneous surface of which presented forwards and upwards. The condyles of the femur were felt in the popliteal space under the distended skin; but the pulsation of the artery was not felt so superficially as usually described; it was obscured in the space between the condyles. The triceps projected, and the tendons of the crural muscles, inserted internally and externally into the tibia and fibula, were stretched, and formed two bent cords, posterior to the concavity. The limb was very mobile, flexed easily, and without pain; extension was more difficult, and attended with some pain. The foot turned inwards or outwards, according to the position given to the limb. The shortening did not exceed one inch and a quarter.

A swelling, scarcely perceptible, existed at each extremity of the transverse diameter of the knee. The patient suffered very little. No ecchymosis could be perceived, and M. Jaequot was inclined to think that if anything was ruptured, it must be the crueial ligaments, and some fibres of the gastrocnemii muscles; it was evident that the tendons were intact.

Extension was made, and the limb being stretched moderately by three individuals, in a few seconds the reduction was effected. A fracture extension bandage was employed for twenty days, removing it occasionally, when flexion was effected without difficulty by the surgeon, but not by the patient without the assistance of his hands. There was slight swelling the first few days which then subsided. No pain in the knee but pain in the sole of the foot and along the tendo Achillis, particularly at its insertion. This pain lasted a long period, was at times very intense, and did not appear to be caused altogether by the apparatus. When the ap-

paratus was removed, the patient could very partially bend his leg, but, by degrees, the power of voluntary motion returned, and by the 30th of August the power of flexion was, to a great extent, recovered, and he could limp about twenty paces without assistance. The left knee was at this time still somewhat enlarged. On the 3d of September he walked without limping, experiencing only towards the evening rather more than usual fatigue.

M. Jacquot remarks that Velpeau and others deny that a dislocation of the knee can be produced by flexion or extension alone, and that this case tends to invalidate that opinion.

He gives a complicated theoretical explanation of the manner in which this happened, but the simple view of the case taken by the editor of the "Archives" is doubtless the true one. "There was not only extension of the leg, but also a rapid fall of the body towards the earth; that is to say, a force which tended to slip the condyles of the femur over the articulating surface of the tibia. It appears to us that the combination of two forces tending to produce the extension of the leg and the rapid fall of the femur downwards, might very easily produce a dislocation of the tibia forwards.

A case of *ununited fracture* of both bones of the *fore-arm*, cured by *acupuncture* with two long needles, left to remain between the ends of the bones for six weeks, and causing great pain and tumefaction, and on their repetition, fifteen days afterwards, suppuration, but ending in six weeks by *proper splinting* in consolidation, is related by Dr. Wiesel, (*London Med. Times*, January 11, 1845, from the *Giornale per servire ai Progressi*.) The splints probably did more than the needles. (See our author, M. Velpeau's text on this subject, in this volume.)

Fracture of the Costal Cartilage and Rupture of the Vena Cava—Mr. R. Pyper, assistant surgeon of Prince Albert's Hussars, (*London Lancet*, October, 1844,) furnishes a remarkable case of a soldier, aged 25, run over by a gun carriage, causing death in a few minutes after the accident, and in whom there were found the unusual lesions of a fracture of the *cartilages* only of the 6th, 7th and 8th ribs, on the right side, in their middle portions, and of the *sternum* just below its articulation with the 5th rib, without scarcely any depression of the fractured extremities of the latter. But the ascending *vena cava* was found lacerated longitudinally from the external surface of the pericardium to the right auricle of the heart. The pericardium was filled with effused blood, and about two ounces were found in the right pleural cavity, but neither the pleura nor the pericardium were ruptured, and the heart was empty and without the slightest lesion.

This case proves; 1st, that the *cartilages*, elastic as they are in the early period of life, as in this case, may, (contrary to the opinion of Boyer,) be *fractured*, if the external force exclusively falls upon them, while the bones themselves escape; secondly, that their very yielding nature may, as in this case, give greater facility for the direct action of an external compressing force upon the large

internal trunks, the explanation, undoubtedly, of the rupture of the vena cava in this instance.

Comminuted Fracture of the Seventh Rib.—Mr. Grantham has seen, (*London Lancet*, October, 1844,) a perfect recovery take place where *seven inches* of the bone was removed in a compound comminuted fracture of the seventh rib from gun-shot wound, and the cutaneous, sub-cutaneous, muscular and ligamentous structures connected with the pleura costalis lacerated without preventing entire recovery. The case illustrates the idea of Bichat, of the isolation of organic functions by *serous* membranes.

Relative Properties of Animal and Earthy Matter in Bones.—We quote the following (from Ranking's *Half-Yearly Abstract*, &c., American Edition, New-York, 1845, Vol. I., p. 262–263,) as containing some of the latest information on this subject, so interesting to surgery.

Dr. Stark has made some very numerous analyses of bones, chiefly with the view of determining the proportional amounts of earthy and animal matters in the bones of the different classes of vertebrate animals. He has examined human bones, and those of an extensive number of mammalia, birds, reptiles, and fishes, and has given a comprehensive table showing the results. (*Edinburgh Medical and Surgical Journal*, April 1845, p. 313.) The most interesting conclusions to be derived from these experiments, are :—1st. The proportion of earthy and animal matters in the bones varies but little over the whole animal kingdom; wherever a true bone occurs, that bone contains nearly the same average amount of earthy and animal matters; therefore, the statement that the higher we ascend in the scale of organization, the larger amount of earthy matters do the bones contain, is fallacious. 2d. The animal matter composes about one third of the weight of the dry clean bone: thus the mean proportion in the bones of all vertebrate animals 66.09 per cent. of earthy, 33.91 of animal matter; the mean proportion in the bones of man is 66.61 earthy, 33.39 animal matter. The proportion of earthy matters in the bones of wild mammalia seems to be a fraction higher than in domesticated animals. 3d. Age does not seem to increase the amount of earthy matters in the bones, as is generally supposed. 4th. The hardness of bone does not depend on the amount of earthy matter contained in it, as is shown in the readiness with which the bones of fish may be cut, although they contain as large an amount of earthy matter as the ivory-like leg bones of the deer or sheep. 5th. Neither increased flexibility, nor transparency of bones (as in the bones of fish) depends on a diminished proportion of earthy solids in its texture; but like that of increased hardness, probably on the peculiar structural arrangement of the tissue. The great fault in the analysis of bones hitherto published is, that the amount of animal matter has been rated too high, probably from want of care in drying the bones and properly freeing them from fat or oil previous to burning. Dr. Stark alludes to the excessive fragility of human bones as contrasted with those of animals, so that when prepared

for chemical examination and deprived of their membranes and fat, they may be readily crushed by firm pressure between the finger and thumb; whereas, the bones of the lower animals similarly prepared, will bear the roughest handling without injury. He suggests that this circumstance might account for the fact of human bones never being met with in those tertiary deposits in which the bones of lower animals are so abundant.

Diagnosis of Fractures at the Base of the Skull, either in the Petrous Portion of the Temporal Bone, or in the Orbital Plate of the Temporal, or in the Ethmoid and Sphenoid Bones.—Nothing certainly can be of higher value to the student than a true *diagnosis* founded on unerring principles. In addition to what we have said in a note towards the conclusion of this volume on the *diagnostic* marks of fractures at the base of the cranium, as indicated in the traction of the uvula, &c., we have recently some exceedingly interesting facts communicated by Dr. Laugier, (*Archiv. Gén. de Paris*, Août, 1845—see also Ranking's *Half-Yearly Abstract*, &c., Amer. ed., New-York, 1846, Vol. II., pp. 84–5–6,) who, after remarking upon the usual *discharges* of blood from the ears, nose, &c., which for centuries surgeons have usually halted at as a sufficient mark of the mischief within, shows by attending to the modern and more minute and thorough modes of post mortem investigations of organic lesions and structural changes, that after the discharge of blood on the immediate occurrence of contusions and fractures of the cranium, (as on the vertex from a fall, &c.,) there will be also frequently found a remarkably large and constant discharge of *watery* serum from the ear, sometimes to the amount of *half a pint*; and that this limpid fluid denotes fractures of the os petrosum, with or without displacement and laceration of the dura mater, but *with* laceration of the membrana tympani. The fluid being, as Dr. Laugier supposes, the *serosity of the blood*, which, after the hemorrhagic extravasation within the brain has coagulated, filters as it were through a chink (or mere fissure—displacement of the fragments of the fracture not being essential) in the os petrosum into the cavity of the tympanum, and thence into the external meatus. [Doubtless the same fluid oozes also through the eustachian tube into the fauces. T.] A similar serous discharge may also ensue into the nasal passage from similar *fracture-cracks* [as they may be called. T.] in the *orbital plate* of the temporal bone, that of the *ceribriform plate of the ethmoid*, and the *sella turcica* of the sphenoid bone.

From the whole of the cases which have been examined, Dr. Laugier infers: 1. That the appearance of the watery fluid in the ear always indicates fracture of the petrous portion of the temporal bone, but with hardly any appreciable separation of the pieces from each other. 2. That an effusion of blood between the dura mater and the bone is constantly observed over this fracture. 3. That laceration of the membranes of the brain is not essential to the production of this symptom. 4. That if the fractured portions of the petrous bone be separated a line or two from each other,

blood alone continues to be discharged from the ear, but no watery fluid.

The fluid cannot be that of the cerebral cavities, but is the serosity of the effused blood, squeezed out by the pressure and motions of the brain, and filtered through the narrow fissure. The objections to this opinion are: 1st. The quantity of watery fluid which sometimes escapes. 2d. The differences observed between the fluid and the serum of the blood. In one case nearly twenty ounces were discharged in three days, and in another ten ounces in forty-eight hours. This appears too large a proportion to the coagulum found under the fissure, but the latter, having been subject to compression, is found almost dry, which at least proves it to be one source of the fluid. In wounds of the soft parts, with effusion of blood into the wound, when this ceases to flow externally, a serous discharge, which saturates the lint and compresses, succeeds, and this is exactly what happens in the case of the ear. Dupuytren always concluded, from the appearance of this watery discharge from deep wounds, that hemorrhage had taken place within. In both cases it comes from the effused blood, and also from the lacerated vessels themselves, after they have ceased to pour out blood. The fluid from the ear differs chemically from serum, in containing a double portion of chloride of sodium; and, although heat and nitric acid produce no coagulation, shreds of coagulated albumen or fibrin are observable in it; but Dr. Laugier does not consider the analysis sufficiently exact to confer much weight on any objection that might be raised. That the origin of the fluid is not from the natural cerebro-spinal fluids is obvious, from the membranes of the brain being in many cases uninjured. That it is not the fluid of Cotugno is plain from its quantity, and from the fact that in many cases the openings of the internal ear remain intact.

Foreign Bodies lodged in the Cranium.—In alluding in the text to a case of Dr. Cheesman of New-York, in which a portion of a gun-barrel remained clasp ing for a long time the neck of the radius, (we think) we are reminded of a recent case related by Dr. O'Calloghan, (Dublin Med. Press, Feb. 1845, p. 82,) wherein, from the explosion of a fowling-piece, a severe wound was inflicted in the forehead immediately above the nose, in an officer of the Ceylon Rifle Brigade. Pus, bloody serum, and fragments of bone afterwards passed through the nostrils from the wound. The patient recovered and returned to duty, but in a few months was incommoded by a metallic substance protruding through the palate, with an offensive discharge, which he was entirely unconscious of, as the sense of smell had been entirely destroyed by the accident. The patient having afterwards died from intemperance, there was found, on examining the head, *the whole of the iron breech of a gun, with the screw attached, lodged in the forehead, weighing three ounces!*

The luxation of the Axis backwards upon the Atlas has been noticed in a recent case at Bordeaux by M. Hirigoyen, (*Bull. Méd. de Bordeaux, and London Med. Times*, Jan. 11, 1845,) being the third case only on record of that accident, those of J. L. Petit and Sir

C. Bell being the other two. The man, aged 60, fell on his head on some sand, and died in a few hours, with all the symptoms of compression. There was no lesion internally any where, and none in the brain; but the medulla oblongata was found pushed backwards and somewhat flattened against the posterior portion of the atlas, and the left odontoidan ligament found torn near the processus dentatus, the right crossing the transverse ligament and preventing the apophysis from rising above it, so that it formed a projection. There was no fracture.

Inflammation of the Spinal Chord from Injury to the Vertebrae.—

It is so rare that we have the opportunity to furnish the pathological appearances after death, as well as the previous symptoms during life, in lesions of the spine, important as such investigations are, and imperative as they should be deemed wherever autopsic examinations can possibly be made, that we take pleasure in transcribing the following from Dr. Thomas Inman. (*See Report of the Liverpool Pathological Society in the Edinburgh Med. and Surg. Jour.*, Oct. 1845, also *Ranking*, Vol. II., Am. ed. 1846, p. 94.)

A. B., a porter, aged 45, fell backwards against a wall, from a ladder, striking his head in its descent.

Immediately after the fall he was completely paralysed, respiration being carried on by the diaphragm alone; his senses were unaffected; no particular pain was complained of; fracture was suspected, but no manipulation was resorted to for fear of increasing the mischief. The next day he was able to move his arms a little, and two days after he could move his legs. On the third day the arms began to twitch, and continued in a state of tonic contraction; some power of motion remained in the legs till the sixth day, when the paralysis was complete. There was never any sensation in the lower, and very little in the upper extremities. Dull aching pain was complained of in the neck. A large slough rapidly formed on the sacrum, and death ensued on the tenth day after the accident.

Post-mortem examination revealed a fracture through the body of the seventh cervical vertebra passing obliquely, and partly through the intervertebral cartilage between this and the first dorsal. The *dura mater* of the chord was lacerated at this point to a small extent, but no effusion of blood had taken place. With this exception, all the membranes looked perfectly healthy. On examining the chord, however, an appearance was noticed anteriorly, like an ecchymosis, and on making the incision at this part, the medulla was found reduced to a brownish pulp. A stream of water being gently turned upon this, washed away the softened portion, leaving a cavity large enough to hold three peas. Its situation corresponded to the giving off of the lower nerves going to form the brachial plexus. The chord was healthy in every other part.

The other viscera were examined, but presented no remarkable appearances.

Disease of the Spine, counterfeiting Disease of the Hip-joint.—

The former followed by abscess in the loins and discharge of portions of the lumbar vertebrae.—Mr. H. Johnson, (*London Lancet*, Aug. 30,

1845—Ranking's *Half-Yearly Abstract*, American edition, Vol. II., New-York, 1846, p. 82-3,) has furnished a diagnostic mark of *spinal* disease, which may, if found verified, prove of eminent practical value. In a patient in whom the body was bent over, with much lameness and pain constantly referred to the fore part of the hip, he found by the usual modes that the head and socket of the femur were nevertheless sound. After a few months an abscess formed in the loins, and portions of the lumbar vertebræ were discharged, terminating in a perfect cure.

So true diseases of the hip-joint are constantly referred to pain in the knee; and those of the lumbar portion of the spine, as we see from the direct connection between it and the femur, are apparently by the pain, &c., supposed to be located in the acetabulum and head of the femur.

Tumors.—Among the beneficial results for humanity, growing out of the more thorough and searching investigations now pursued in the *analyses*, (for the term is here also applicable) of microscopic anatomy, as well as micro-chemistry, may be mentioned the general substitution of regulated and philosophic systems of *food and regimen*, as a preventive, or even curative means of many morbid structural changes in the organism, that have hitherto been deemed removable only by the knife of the surgeon. This belongs in fact to the great department of *Conservative Surgery*, which we have so much insisted upon in our notes in the text of this work, see under Amputations,) and in which we are fully borne out by the opinions of Dr. Mott, than whom certainly no one could be listened to with greater attention, in what concerns the relinquishment or abridgment of surgical for milder remedies; for who has dealt so largely, and with such brilliant success, in the first-mentioned class of those resources of our art, as that great surgeon?

A learned and practical member of our profession, Henry Ancell, Esq., of London, in his report on the Progress of Surgery, (Ranking's *Half-Yearly Abstract of the Medical Sciences*, American edition, New-York, 1845, Vol. I., p. 222, et seq.,) and who as one of the earliest illustrators of the great truths unfolded by Leibig, merits the lasting gratitude of the profession, (see his Discourses in the *London Lancet*,) thus speaks in eulogistic terms of the recent work of Mr. McIlwain, on Tumors, (London, 1845,) inasmuch as the last mentioned author, evincing that he keeps progress with the advance of modern sciences, boldly, and as we think, truly, maintains that those morbid growths called *Tumors*, whatever be their classification, are to be chiefly ascribed to improper attention to the nature [and quantity he might have added. T.] of our food. On which account, Mr. McIlwain very naturally looks to the *liver* as the direct source of such morbid and abnormal productions. In other words, he ascribes the growth of tumors chiefly to sedentary habits, and the indiscriminate use of alcohol, and greasy, fatty, and saccharine food, because of their superabundance of carbon. *Ab inverso*, the cure or prevention lies in the abstinence from such indulgence and strict attention to exercise and regimen.

Hence, says Mr. McIlwain, the inutility of topical applications. He instances even the cure of *cancerous tumors*, by rigid adherence to these rules, which was proved moreover by a return of pain at every transgression of regimen.

[The faultless forms of organic development, handed down to us in the paintings and sculptures of ancient Greece, while they are speaking memorials of the supreme health which existed among that people, receive a ready solution, in the philosophy which governed them in their rules of social life, especially in the cultivation of manly sports, athletic exercises and games, and free exposure to the open air and adherence to a frugal diet. This made them and the Romans, successively, so great a military nation, and the conquerors of the world. T.]

Mr. McIlwain believes that he has by his course of *Medical Surgery*, succeeded in dissipating by absorption, at least *ten or twelve malignant tumors*.

The first change is in the tumor becoming, as it were, *loosened* or isolated from its connections, and this without the aid of any medicaments as opium, &c. ; the next is that it appears to be broken up by furrows into separate portions. [This we have seen remarkably illustrated in the use of hydriodate of potash in ointment to chronic cold bubonic tumors. T.] Absorption then completes the cure. Thus, says Mr. Ancell, nature triumphs over what surgery would have hitherto called hopeless disease.

In the treatment of *Erectile Tumors* by *inoculating them with Croton oil*, which we have alluded to under those tumors, Dr. Alexander Ure, (London *Med. Gaz.*, March 21, 1845,) states that he has succeeded in one instance where a tumor of this kind of the size of a currant was situated at the inner angle of the right upper eyelid in an infant aged $3\frac{1}{2}$ months. The oil was introduced by several minute punctures on the point of a cataract needle—and repeated twice. The tumor inflamed and rapidly withered away.

In a case of large *Congenital Erectile Tumor* on the left cheek, which had existed for years, in a man aged 27, at the New-York Hospital, Dr. Alfred C. Post, one of the surgeons of that Institution, found it advisable, from its rapid growth and inconvenience, to try the effect of a ligature on the left primitive carotid, which he performed April 19, 1845. (See Dr. Lee's *New-York Journal of Medicine*, January 1846 ; Vol. VI., No. 16, p. 11.—Proceedings of the New-York Medical and Surgical Society.) The tumor perceptibly decreased as soon as the operation was performed, and has continued to decrease.

THE DEXTRINE BANDAGE OF M. SEUTIN, COMMONLY CALLED THE STARCH BANDAGE, OR BANDAGE INAMOVIBLE, OR BARON LARREY'S BANDAGE.

La Méthode Amovo-Inamovible, (literally translated, the removable-immovable bandage,) of M. Seutin has lately become the subject of an animated discussion at Brussels itself, the seat and throne of its empire, and of its founder and champion, M. Seutin, in his own

hospital of St. Pierre in that capital. The Royal Academy of Medicine of Brussels, induced probably from some disastrous information received from other countries, (to wit, the case of M. Dubowsky, &c., see our Vol. I.,) of the ravages produced by the reckless use of M. Seutin's bandage, and influenced doubtless, in some measure also, by the unfavorable experience which a surgeon at the head of another hospital, in Brussels also, (M. Uytterhoeven, of the hospital of St. Jean,) concluded to institute a commission of enquiry to confer with M. Seutin and determine its true value, and the facts in the case, at the fountain head.

Some discrepancy occurring between the parties, as to the mode of investigation, a warm and somewhat angry discussion ensued before the Academy, at several recent sittings. (See especially, (*Gaz. Méd. de Paris*, t. XIII., No. 39, Sept. 27, 1845, p. 617-624.) It is curious to see in this debate, the national pride of the commission which while censuring M. Seutin's course in this affair merely, clings still with blind pertinacity to the supreme value of the dextrine method, as a brilliant plume for Belgium and her son! We have said enough, (in our Vol. I., and also this Vol.,) of the terrible destruction caused by the instant employment of such solid, unyielding stone-like encasements, as the various forms of Seutin's bandage, in the occurrence of fractures, &c., to make it unnecessary to repeat our cautions and interdictions here. We could also say much of similar deplorable results that have occurred in this country, in the hands of one of our first surgeons, deluded probably as he was with the infatuation which still seems to hold possession of the minds of the author of the method, and some others who have adopted his recommendations.

Meanwhile, without going farther at present, in the short limits left to us, into this matter, or wishing to be understood to apply our censures to the more considerate and prudent modifications of *inamovible* or *amydonné* bandages as employed by the real author of the process, Baron Larrey, and by our learned author, M. Velpeau, who asserts his claim also, as the discoverer of the best form of these dressings, we avail ourselves, with a view to do full justice to M. Seutin, of the opportunity now fortunately presented to us in the discussion mentioned, to furnish his own latest defence of his process or method, as disclosed by him in his remarks before the Brussels Academy, as already referred to.

M. Seutin, using now a new and rather *outré* nomenclature for his method, *amovo-inamovible*, said boldly, (Loc. cit., *Gaz. Méd.*, &c., p. 620, &c.,) *that he defied any one to produce a single instance of failure against his method (!)* He did not mean here, against the *starch bandage*, so called, composed of some pieces of pasteboard and bandages covered with starch, but the whole method, as properly understood. Thus, he continued, we must not lose sight of the ribbon (*ruban*) of oiled or greased thread, which is found under the bandage, between the skin of the limb and the first layer of the bandages, which he names *compressimetre*, as indicating the degree of compression of the bandage. If, in two or three hours after the dressing is applied, he finds, on pulling the ribbon, that it

draws too tightly, and the patient complains of any uneasiness, he cuts the bandages, (*je fais l'incision*;) on the contrary, the bandage is left on as long frequently as forty-eight hours; but usually, whether the ribbon glides or not, or whether there be or be not any necessity so to do, he incises as soon as the disiccation is completed, opens the bandage from one end to the other, and in an instant the *appareil* is thus reduced to the ancient bandage, with the advantage that the limb being maintained in all its parts by means of a gentle and methodic compression, we have already obtained a resolvent effect superior to that which is procured by cold application, (*le froid*), cataplasms, and other means, leeches, cuppings, scarifications, fomentations, &c. [If one side, the anterior surface for example, is thus laid open always by M. Scutin, it gives an entire new aspect to this method; for the great objection of a close, unyielding encasement is overcome, showing thereby that M. Scutin has yielded more or less to public opinion, and abandoned, as we think, his first mode. In truth, he converts his apparatus into a gutter, (the present favorite, and, as it is no doubt the most rational and efficient, mode of treating all fractures, as enforced and adopted more especially by M. Bonnet of Lyon, (see above,))—this *gutter*, in his case, comprehending nearly, we presume, the whole periphery of a cylinder. But even here, also, the compression, as is well known, still continues too great, as every portion of the limb is still imprisoned in its petrified encasement, except the strip of space immediately opposite to and in a line with the slit or incision which has been made, and which *fenêtre* consequently (like an air-hole in ice) is the only place where the tissues can find egress for the tumefaction which must and ought to ensue in all fractures, as the result of the organic inflammation essential to the restitution of the parts to their normal condition, and especially to consolidation of the fractured fragments. We contend strenuously for this great principle: that the local inflammation and constitutional reaction must be expected and also encouraged to a certain extent, but yet restrained and controlled, by laying the limb for the first few days on a mattress, and supporting it gently with pillows, while at the same time leeching, and afterwards anodyne saturnine lotions (not cold) are judiciously applied; or, at first, it is frequently necessary to employ venesection also, and purgatives, and a cooling regimen, for some days. After that, when the constitutional and local action has subsided and disappeared, then is the time for *gutters*, and in some instances, perhaps, for M. Scutin's present modification of his *desiccated dextrine gutter*, or *cylinder*, as it should be called, so as we understand him. T.]

If, then, continues M. Scutin, I perceive that compression in any point is about to become injurious, I remedy it immediately. By widening the two valves, (*i. e.*, as we suppose, the two lips or borders of the slit above made,) I always preserve the half of the limb and bandage in a state of immovability. [It is then, in fact, a *half-cylinder gutter*; and if the pressure is not still too great, we think this modification of the *gutter* apparatus, in so far as its exact adaptation to every part of the contour and length of the limb which

rests upon it, should have the decided preference over every other method, provided always that it is never used in the first days, and not until after all inflammation and fever have subsided, as we have pointed out. In so far we accord wholly with M. Seutin, and the result we hope will be, that he and those adverse to his first processes more especially, will meet upon a middle ground—a *juste milieu*. T.]

If, says M. Seutin, I have to open abscesses, or proceed to the extraction of splinters, I experience no difficulty; and afterwards pass to the dressing. During all this period, it is impossible, says this surgeon, that the limb plays, as you have been told, like a pestle in a mortar!

This amydonné *shell*, (coque amidonnée,) thus cut, M. Seutin asserted would, and had, in a diseased elbow or white swelling, reduced the articulation to its natural volume in eight days.

In wounds from fire-arms, he cuts the bandage, he says, in the direction of the wound, and makes in that part openings through which he extracts foreign bodies, and performs the dressings.

Also, not even in the *most comminuted fractures* has the patient need of remaining in bed; but, in a very short time after the desiccation of the bandage, may get up and walk with crutches.

The great objection to M. Seutin's method is this: that even in such dangerous fractures, with protrusion of the osseous extremities, he demands, as an indispensable preliminary, (and for what? to prevent the inflammation and swelling!) that his *dextrine bandage* should be applied *instantly*—the very mode, certainly, of aggravating both, especially in these worst and most complicated cases, in which he most insists upon it, because here the inflammatory consequences of the wound themselves must necessarily, in any event, be violent, and the counter-compression, or hard shell, or gutter, even whether half open or not, must dangerously augment those symptoms.

Nevertheless, we object with him to the opposite extreme of mild *cataplasms*, as in most instances tending to favor suppuration. Equally objectionable are *stimulating* fomentations at the onset, and which are so commonly and improperly applied, among the first measures resorted to.

It turns out, in fact, in the course of this debate, that the amydonné apparatus of M. Seutin has been, in a measure, interdicted at the hospital of St. Jean, at Brussels; and that the opponents of his method at that capital, while they admit of its application in simple fractures, prohibit it in those that are complicated or compound.

But, says M. Seutin, the more the case is complicated, the more we should seek to prevent the inflammation and its accidents. This is true; but *not* by compression, constriction, &c., by his method. Still, he insists thus: "Replace the bones, approximate the soft parts, establish a *gentle* methodical compression, and keep the whole in a state of *complete immobility*, and combat the accidents; this is what should be done *immediately*, in a complicated fracture."

It is unnecessary to reiterate our hostility *in toto* to this course, under such circumstances. The compression cannot be *mild* or gentle, (*douce*,) and the *immobility* requires no compression.

He perseveres, however, in declaring that, by the immediate application of his method, you will *prevent* the inflammation and accidents; whereas these results, he says, will be more likely to be developed if the bandage is delayed; moreover, the action of the muscles, if the limb is thus left uncompressed, will have a better opportunity to displace the fragments, and cause them to ride over each other by *chevauchement*; and a thousand other unpleasant consequences, he contends, may also ensue. At the very onset, he says, the fractured ends may be placed in more exact coaptation. We perceive, however, that he takes good care to enjoin that the action of the bandage (as above described) on the limb should be *closely watched* and *cut in time*; also that the patient should be bled, and have an emetic, &c., (if necessary.) Why speak of *bleeding*, if it were not certain that M. Seutin's mode does not prevent inflammation and fever, &c., as he would lead us to suppose?

The report itself of the commission we have not been enabled to see; but it leaks out in that, that they declare openly that this pretended gentle (*douce*) methodical compression, so professedly exempt from accidents, becomes, in their opinion, so much the *more dangerous*, as it depends upon the tact of the surgeon, (*dépend du tact du chirurgien*;) *i. e.*, as we understand this expression, (so obnoxious to M. Seutin,) this compression is more likely to be severe, from the surgeon having the arrangement of it. The commission, it seems, were also aware of the alarming tumefaction, gangrene, sphacelus, &c., sometimes resulting from the method of M. Seutin.

Mal-address, M. Seutin admits, may produce reverses; but never, since he adopted the plan of cutting the bandage and using the ribbon compressimeter, has he met (he affirms) with a single accident.

He calls the attention of the Academy to a recent case in his hospital, that some of them had witnessed; a fractured leg, crushed by a heavy weight, with an infinity of splinters, hemorrhage, &c., all indicating amputation, but then nearly well by the instant application of his bandage.

He admits, however, to have since lost another case of compound fracture of the leg, and where the *amydonné* bandage, even with a fenêtre over the wound, did not prevent a fatal *trismus*! So much for its power to restrain muscular action. Why may not the very *compression* itself probably have caused the *trismus*?

Let others, exultingly exclaims M. Seutin, imprison their patients to the bed for weeks, rob a youth full of restlessness and ardor of two or three months of his existence, expose an old man to the dangerous effects of hypostasie, &c.; for myself I shall take the liberty to deem this method defective, in fact *inhuman*. It is my opinion!

Never can an accident result, he says, from the proper employment of his method! This, to say the least, is a sweeping assertion.

M. Seutin is in error in supposing that the great antagonism to his doctrine and method is a preference to the ancient modes of treating fracture. He ought to know that the real and solid obstacle to the possibility of his making any further converts, except by a still more liberal *dilatation* and retrenchment of his *coque amidonnée* than public sentiment and notorious facts have already compelled him to make as unavoidable concessions, and as a reluctant abandonment of his primitive views, is the rapid advance of the great principles of *conservative surgery*, (see notes in this Vol. II.,) on the true treatment of the worst kinds of complicated fractures and dislocations of articulations, by which the mildest *gentlest* dressings, (if dressings they can at all be called,) and the most soothing treatment, general and local, with an abhorrence of all compression or constriction, are now received as the true basis of the treatment of those fractured wounds to which M. Seutin immediately applies his method.

His is the method in fact which justly merits the epithet of incarceration, and that too in a dark dungeon—at least so it was at first. Moreover the same *encasement*, too constrictive in the first days, did the patient survive its application, became frequently too loose afterwards, and thus truly, as the commission said, the leg dangled and flapped about as it were in a hollow cylinder, now too big for it. Can M. Seutin say, that in placing his patient on crutches at that time, that there would be security against displacement or chevauchement or refracture? Or that these accidents ever could be avoided, however tight the compression should be, while the patient was hobbling about his room on crutches twenty-four hours after the accident? Would such locomotion favor coaptation, or be calculated to prevent the gravitation of blood to the limb, (as the thigh or leg for example,) and an increase of inflammation and tumefaction in a less degree than would the repose of the patient quietly on a mattress, with the limb protected by cushions and bolsters, till the inflammatory symptoms had subsided?

It was quite unnecessary, as we think, for M. Didot, who appears as the special champion of M. Seutin in these discussions of the Academy, (sitting of the Royal Academy of Medicine of Belgium, June 29, 1845; *Loc. cit.*, *Gaz. Méd. de Paris*, Sept. 27, 1845, p. 621, et seq.,) to mourn over the loss which Belgium would sustain by having been robbed of this discovery; for we imagine the time is not far distant when there will be found very few of the profession any where who will not be disposed to repudiate a contrivance so purely mechanical, and so beset with dangers as the method of M. Seutin. For it must be constantly borne in mind that we speak of the *méthode amydonnée* as originally proposed by M. Seutin in 1834, and for many years pertinaciously employed by him, until within a few years, or very recently, as by his own confession [thus: *mais je puis le dire, depuis que je coupe le bandage amidonné, depuis que j'y ai mis le ruban compressimètre, il ne m'est pas arrivé un seul accident; il ne peut plus même en survenir, (!!)* (*Loc. cit.*, p. 621)] he was compelled to make the great

modifications in question, by which his apparatus in fact has been reconverted into one whose principle was long since known, and is now beginning to be universally adopted, viz., that of a well adapted gutter to the limb; so that in fact the *méthode* is no longer what it was, a bandage amydonné enveloping the whole limb, but as M. Seutin now calls it, a *coque amyglacée* or *amidonnée*, in fact, a *gouttière amidonnée*, now slit open or cleft from one extremity to the other, and with a compressimeter, &c., to mark the degree of pressure. So that in fact M. Seutin has now deemed it advisable to change even the name of his method, to that of the rather unintelligible and contradictory phraseology of *méthode amovo-inamovible*!

It was unnecessary, therefore, for M. Didot to express so much anxiety as to the Belgic parentage of an invention which has been obliged, by the force of public opinion, to be almost totally changed in its character by the author himself. Much less was he called upon to make use of the disparaging remarks which he has towards our author M. Velpeau, and others, actually charging the Professor of La Charité with having suppressed the original description of the method transmitted to him by M. Seutin, and what is worse, *counterfeiting* it and appropriating it to himself under the name of *enveloppe dextrinée*, &c., the difference in M. Velpeau's process consisting only in using dextrine instead of starch! All of which it would be difficult, when we have the published fact (admitted by M. Didot) of M. Velpeau, giving to M. Seutin all the credit that we think he could be ambitious of receiving for his *primitive* process.

The great superiority of the Seutin method, according to M. Didot, consists in preserving by exact circular compression the *immobility* of the limb, while it allows of the general *mobility* of the body, *i. e.*, locomotion on crutches, which he contends, hastens the consolidation, at the same time that the dressing has the advantage of being moved [rather modified] according to necessity, so as to avoid unequal pressure. Hence it possesses amovo-inamovibilité.

The *disrepute* into which the Seutin process has fallen in some quarters, M. Didot ascribes wholly to the ignorance and carelessness of those who, pretending to employ it, apply it in such manner as to make of it a barbarous transformation of what it in reality is. Thus they apply a roller bandage instead of separate pieces, and adjust it close to the epidermis, causing the latter to slough off (decoller) upon the contraction of the subjacent parts, or they make too hard a compression when the osseous projections have not been properly managed by separating the pasteboard from them, and using less starch in those places.

The *déambulation* or locomotion so much boasted of, and which even in this country is bandied from mouth to mouth among the vulgar, as one of those marvellous things which have done much to spread the fame of the author, (without any accredited facts, however, to sustain it here,) is stated, it appears, in the report of the commission itself, to consist in nothing more than the power of removing the patient out of his bed and placing him on a chair! M.

Lutens, however, in the discussion, asserts boldly that it was established beyond all doubt that the patient can and does by M. Seutin's method move about his room on crutches, or in his garden, or go without danger upon a voyage, and apply himself to certain occupations!

M. Lebeau, a military surgeon of high rank, and who was president of the commission, while expressing himself in the most eulogistic terms of the great discovery of M. Seutin, and repelling every imputation of personal hostility on the part of the members of the commission towards M. Seutin, or that any other than strict impartiality towards that surgeon was intended in their report, nevertheless censures M. Seutin for declining to allow the commission to go into a general inquiry, but that they should confine themselves only to the nine cases which then happened to be under treatment in M. Seutin's hospital.

We confess, however, after carefully perusing the minutes of this discussion, that the extreme laudation of the invention on the one hand, coupled in the same breath and from the same mouth with disparaging reflections upon the consecutive dangers of the method in compound and comminuted fractures especially, such as extreme difficulty in properly applying it, the violent irritation, pain, &c., which the least compression produces in some patients, followed in some cases by *sphacelus* or *tetanus*, if the bandage is not quickly ripped open, all of which contradictions are seen in the remarks of M. Lebeau himself, as well as others, are to us in this country perfectly irreconcilable and incomprehensible.

It is noticed also that M. Lebeau refers specially to certain imperfections in the original process of M. Seutin, which the latter surgeon has found it necessary to correct.

Again, therefore, we remark in conclusion, among the other incomprehensibilities of this discussion, that the panegyrics of M. Lebeau on the invention, as one that does so much honor to Belgium, appear to us more like a *rhapsody* or mockery of the process, if we consider the invention under the point of view at which it first emanated from M. Seutin's hands. Thus, M. Lebeau asks the Academy if they have forgotten that foreigners wished to rob M. Seutin of this *precious conquest*, (!) so fruitful of successful results, (!) and which may be considered as a plume which does honor to Belgic surgery!

It is proper to state that the Peruvian plant *matico*, of the virtues of which as a hemostatic remedy we have given an interesting account from Dr. Ruschenberger of the U. S. Navy, (see this Volume under Dr. Mott's chapter on Aneurisms,) who first introduced its employment in this country, has also been used by many practitioners of Great Britain in the form of decoction internally, and the under side of the leaf externally, viz., by Dr. Munro of Dundee, Dr. Jeffreys of Liverpool, (for vaginal hemorrhage,) Dr. Lane of Lancaster, &c., (see *Braithwaite's Retrospect*, Vol. VIII., 1843, p. 48, &c.)

Ligatures on Important Arterial Trunks.—Dr. Mott has on

several occasions established it as a principle in all his operations on osteo-sarcoma of the jaws, and tumors, &c., of the neck, to be prepared to place a ligature on the *carotid trunk or its divisions*, whenever required, either as a preliminary step, or contingently during the course of the operation. As examples in anticipation of two cases of his which we shall give under their appropriate head of *tumors*, we may mention that of his ligature on the *external carotid* in extirpating the *parotid gland*, July 13th, 1831, (see *Amer. Journ. of the Med. Sciences*, Philadelphia, 1832, Vol. X., p. 17—20,) and his ligature on both the *external and primitive carotid*, during his extirpation of an enormous tuberculated sarcoma from the neck, in February, 1832, (see *Amer. Journ. of the Medical Sciences*, Philadelphia, 1833, Vol. XII., p. 121—122.)

In this last case, it may be well to remark, in relation to the effect of the growth of vast tumors upon the superincumbent muscles, that the *sterno-mastoid* (as in the case of Dr. Mott, of which I have given a short description in the notes at the end of this volume) was here also found *expanded in its whole course over the tumor*, and so attenuated as to be reduced to the laminar character of the *platysma myoides*, (*Ib.*)

Another triumphant case for *conservative surgery*, and for the cure of *aneurisms by compression*, as now established by the Surgeons of Dublin, is recorded in the *London Medical Times*, (Feb. 1, 1845,) wherein a soldier of the Coldstream Guards, aged 27, with popliteal aneurism filling up the whole of that space, was radically cured in the space of *one day*, it may be said, by the employment of an Italian tourniquet, the patient himself during the space of twenty-four hours, changing the pad to a position higher up on the femoral artery, so that, incredible as it may seem, the *tumor in the short space of time* mentioned, (*i. e.*, in twenty-four hours, or from July 8th to July 9th, 1844,) was found *perfectly solid*, and no pulsation or hollow sound afterwards perceived. The compression was continued for nine days longer, and when the instrument was removed, the femoral artery was distinctly felt to pulsate down to its entrance into the tendinous canal, and two arteries of the size of crow-quills could be traced over the surface of the now hard and solid tumor. From that date the swelling gradually diminished, and the patient began to walk Aug. 9th, and returned to duty Dec. 12th, which he had efficiently performed up to the time of the record of the case, Feb. 1, 1845.

I add here, with regret, that this *important plan* of the cure of aneurisms has not been received at our public institutions with the ingenuousness which ought to distinguish a profession like that of ours. Some imperfect attempts have been made without due attention to the proper mode of employing two or more *clamps*, (like those of carpenters,) as enjoined by Dr. Bellingham, (see our note under Arteries,) by which carelessness the *process* so important in behalf of humanity, has been prematurely condemned, and the favorite severe surgical operations on the femoral, or amputation, resorted to. The process of the Dublin surgeons has found a warm

advocate in M. Giraldés, of France, (*Journal de Chirurgie, Mars, 1845.*)

A remarkable case of *dissecting aneurism* is related by Dr. Mc Donnell, (*Dublin Journal*, January, 1845,) in a woman aged 50, who, dying very suddenly, presented the following appearances:—The semilunar valves were perforated in different places, and especially near their free borders by round and oval apertures. The aorta was sound at the place of insertion of the valves, but about one inch above this point was a transverse laceration as smooth as if divided by a bistoury, through the internal and middle coats without implicating the external. It was $1\frac{3}{8}$ of an inch in length, and a sound could be passed through this opening freely between the external and middle coat as far as to a point corresponding with the upper border of the semilunar valves, but not behind the sinus of Morgagni. A pale fibrinous clot was found over this laceration. The dissection of the coats was traced to the bifurcation of the innominate on the right, and as high on the left as half an inch upon the origins of the carotid and subclavian, without, however, any intermediary clot. There was a solid, large, dark homogeneous coagulum at the apex of the pericardium near the origin of the large trunks. This clot was covered by a transparent membrane. The aperture in the external coat through which the blood escaped, was an inch in length, and situated at the point where the aorta and pulmonary artery approximate. The lungs and liver were engorged.

The peculiarity of this case consists in this, that the blood, after dissecting the tunics, instead of effusing itself into neighboring cavities, insinuated itself into the cellular tissue which unites the external tunic to the detached serous coat of the pericardium between the aorta and pulmonary artery, forming there a solid clot. The aorta, except at the place of laceration, was greatly degenerated, being filled with osseous plates and etheromatous depositories.

We regret to find that notwithstanding the broad, palpable and perfectly satisfactory evidence now before the professional world, in proof of the *unfailing success and radical cure of popliteal aneurism, in every case*, (now fourteen or fifteen,) in which the perfected *Dublin mode of compression upon the femoral trunk*, by means of simple clamps resembling those of carpenters, and which can be regulated with ease by the patient himself, (see notes under Arteries in this volume, on the results of this mode of the surgeons of Dublin, &c.) has been tried, still surgeons persist both in London and in this country, in adhering to the ancient favorite anti-conservative practice of a ligature on the femoral. Thus Mr. Hancock, of Charing-Cross Hospital, (*London Lancet*, Part XIX., October, 1845, p. 377,) so late as Sept. 6th, performed this operation on the femoral for a popliteal aneurism, in a case where, from the apparent good constitution of the patient, and the ascertained non-existence of any aneurisinal diathesis in his system, there is every reason to believe a radical cure could have been effected by compression as above mentioned. The patient, as usual in tying the femoral in such cases, had a narrow escape from sloughing of the wound, and

the pulsations in the tumor persisted, notwithstanding the operation, for a considerable length of time, *i. e.*, for ten days or more after it had been performed.

One of our most skilful surgeons in the navy, Dr. Foltz, while with the American squadron in the Mediterranean, and in charge of our naval hospital established at Port Mahon, Minorca, in 1839, '40 and '41, made many interesting observations, which he published in the *New-York Journal of Medicine*, 1843. His remarks on *Aneurisms*, including *nævi materni*, are worthy of record:—

Aneurism.—This is a very common disease; and as its nature and treatment are here but little understood, it generally proves fatal. As we attribute this affection to a diseased nutrition, we may be prepared to meet many cases of it at Mahon. Those of the large arteries, near the heart, are most frequent, and seldom are they confined to a single tumor; they are rapid in their progress, and speedily prove fatal. We made a post-mortem examination, in which five large aneurismal tumors were found upon the aorta and the subclavian arteries; and in this case, the only treatment that had been pursued was Morrison's pills, and at intervals large doses of quinine.

Our introduction to our medical *confrères* of Mahon, and into practice among the natives, was owing to a case of aneurism. Very soon after our arrival, we were invited by Dr. Regal to be present at an operation for securing the femoral artery in a case of popliteal aneurism; and as this operation had not been attempted here for years, most of the faculty had assembled on the occasion. Our first impressions, we must acknowledge, left but little desire to cultivate a further acquaintance. There are, however, among them several gentlemen of liberal education, and well qualified to take a higher stand than they are destined to hold in this community. The patient, a Spanish sailor, æt. 30, had a large aneurismal tumor in the left popliteal region, with strong pulsations in every part of it; the size of the tumor was so great, that the limb from the knee down was œdematous, and pulsations could not be perceived in the arteries below the tumor; the individual was much emaciated, and in an unfavorable condition to undergo the operation. In dividing the superficial layers, much time was unnecessarily consumed, and unfortunately, the vein was opened, which produced a profuse hemorrhage. After much delay, sponging, and tearing, the surgeon was unable to secure the artery. At this stage of the proceedings, our assistance was requested; and from the unfavorable condition of the case, we recommended immediate amputation. This, however, would not for a moment be listened to, either by the medical attendants or the patient. We, therefore, proceeded to make a fresh incision two inches higher, and passed a ligature around the artery, which, as soon as secured, arrested the hemorrhage and pulsations in the tumor. The patient was now placed in bed, directed to be kept quiet, and one drachm of infusion of digitalis ordered every four hours. Notwithstanding the unfavorable prognosis, the case continued to do well until the twelfth day,

when violent pain set in, which terminated in mortification of the foot. The ligature came away on the eighteenth day after the operation, and soon after, the line of demarcation distinctly formed in the middle of the leg; and, after months of suffering, the mortified parts were completely detached, leaving a very clever stump.

The unpleasant duty here devolves upon us to record the death of one of the most affluent and useful citizens of Mahon, in consequence of the officious interference of an ignorant surgeon, in a case of popliteal aneurism. M. Vidal, aged fifty, had enjoyed uninterrupted health for many years, devoting his time to the management of his estates and the enjoyment of domestic comforts. Discovering a small tumor under the knee, which gave him no uneasiness, as it was unaccompanied by pain, he, nevertheless, as it continued to increase, sent for his medical attendant, who pronounced it an imposthume, declaring that he distinctly felt the fluctuation within. Promising to call again and open it, which he assured his too credulous patient would at once relieve him, he accordingly did so in the evening; and boldly plunging a lancet into the supposed imposthume, he opened the cavity of an aneurismal sac which was, of course, immediately followed by a copious hemorrhage. By means of compress and bandage, he succeeded in arresting the bleeding for a time; and now leaving the patient in bed, he assured him that all was just as he had anticipated. The exhausted patient soon fell into a profound sleep, the hemorrhage recurred, and during the night he awoke and found himself weltering in his blood. Scarcely able to articulate, time was only allowed to administer the last rites of the Roman church, when the unfortunate patient expired.

In several cases of aneurism, in which we were consulted, we had the gratification, by a rigid perseverance in the antiphlogistic regimen, venesection, perfect rest, and digitalis, as recommended by Valsalva, of seeing the most happy results follow. In the case of a watchmaker, the individual was enabled, after some time, to resume his usual avocations, and contribute to the support of his family.

Aneurism by Anastomosis.—A few cases of congenital aneurism came under our care; but they are not more frequent here than elsewhere. In their removal we rarely had recourse to the knife, as we found the natives invariably recovered slowly from operations; and, as regards union by the first intention, we do not remember having ever witnessed it, however small the lesion may have been. When these cases of *nævi materni* occurred in children, little difficulty was experienced in destroying them by repeated applications of the caustic potassa. We always took especial care to insert it well within the enlarged blood-vessels, and then waited until the parts had completely cicatrized before a second application was made. The time required for treatment by this method may be urged as an objection; but with the conscientious surgeon, such an objection, when he comes to calculate the advantages of this mode of treatment, will have but little weight; and he will

perhaps be quite agreeably surprised, as we were, on seeing the very small cicatrix left after the use of the caustic; and this, in cases in which the affection is seated in the face, is a matter of no small importance.

In another instance, a large aneurismal tumor, extending from the ear to the angle of the inferior maxillary bone, was much reduced in size by means of pressure with a piece of wood, carved to adapt itself over the surface, to which it was bound. Thus was a hazardous and painful operation avoided; and, in addition to the important blood-vessels involved, the individual was subject to an erysipelatous affection of the head which interposed new obstacles to an operation.

[We would barely note in reference to the above, that we cannot well understand how the depleting, reducing, not to say, exhausting method of Valsalva, could succeed in the cure, where the author in the beginning (above) acknowledges that aneurismal disease at Minorca is, in his opinion, imputable to diseased (*i. e.*, defective or impoverished) nutrition. T.]

The fatal blunder of an aneurism for an abscess, and the division of the femoral vein in the attempt to place a ligature on the femoral artery, furnish corroborative evidence of the low state of surgical science in the Spanish kingdom.

The author still insists on the treatment of Valsalva and digitalis, (now justly, as we think, proscribed,) as will be seen by the following case of one of our fleet, also occurring at Minorca.

Case of Aneurism.—The case of aneurism was in the person of an aged quarter-gunner, who, from his long and useful services, had strong claims upon our careful attentions, but who proved a most ungovernable and unmanageable patient. He was fifty-five years of age, and for twelve months previous to his admission, had suffered much from violent palpitations of the heart, and recently, a tumor had made its appearance beneath the left clavicle, which pulsated strongly. In the umbilical region, there was also a very perceptible enlargement, which not only pulsated strongly when pressed upon in a line with the artery, but communicated the same throbbing sensation when elevated from the spine by lateral pressure, which, as the patient was much emaciated, could be easily effected; and it was from this abdominal tumor that he suffered most inconvenience. His only complaint was from the “*thumping amidship*,” as he expressed it. Having witnessed the most happy results from the strict enforcement of the treatment of Valsalva among the native Minorcans, we were desirous of pursuing the same course in this case; and for many days, and even weeks, when closely watched, he confined himself to his bed, taking no other food than the most mild and unirritating diet, while Withering’s infusion of digitalis was administered to the fullest extent that his system would allow. Under this course he was much improved, which promised at least to prolong his life, and pass it comparatively without pain; but, in the midst of this nursing, he would at midnight leave his bed, scale the walls, and without his clothing

rush to the first grog-shop. Here he would drink, quarrel and fight, as long as he was able to stand; and when overcome by his exertions, he would be brought back to the hospital, to undergo another course of arrow-root and digitalis. When intoxicated, his exertions were powerful, and it was frequently necessary to resort to the use of the straight-jacket, during his *furor*; and at these times, the action of the heart and throbbing in the aneurismal tumors were so violent, as to occasion great apprehension of an immediate rupture. In this situation, it was necessary to bleed him freely; and such was the condition of his fluids, that the blood contained but little coloring matter, and from the scarification, after the use of cups, serum would continue to flow until arrested by a compress. This course continued for many months, until his final return to the United States. We were equally astonished at the great strength manifested by him when under the influence of liquor, and that the case did not prove fatal during some one of his excesses. After each debauch, when perhaps scarcely able to raise his head, he would say that he felt much better; and if we would only give him a little more rum, he would be sure to get well. Had our patient joined the "tee-totallers," it would have been of more service to him than all our medicine and advice.

In our notes in the text of this volume, we have under the cure of aneurism by compression, (see Arteries,) indulged the hope that *electro-puncture*, which was first suggested by M. Pravaz, (see *Dictionnaire des Sciences*, Paris, 1835, t. XI.) might, notwithstanding some contradictory testimony that might be adduced, one day achieve a real triumph for conservative surgery, by effecting a radical cure of aneurismal tumor by means of consolidating the contained blood.

It is gratifying, therefore, that this immediate consolidation and cure were for the first time most satisfactorily accomplished on living man, September 10th, 1845, and that, in the space of a few minutes, before numerous practitioners and students, at the Hôtel Dieu of Lyon, by the distinguished surgeon, M. Pétrequin, (see his communication to the Academy of Sciences, of Paris, at their sitting, October 27th, 1845, in *Gaz. Méd. de Paris*, No. 44, t. XIII., 1845, November 1st, p. 704-705.) The patient, Dasniard, a blacksmith of Lyon, aged 19, was brought into the hospital, August 4th, 1845, insensible from contusion on the left eye, and fracture of the lower jaw, caused by a fall from the second story. He was seized with small-pox towards the end of the treatment, and went regularly through that disease. On Sept. 9th, M. Pétrequin noticed a small pulsating aneurism on the left temporal artery, of the size of an almond, evidently the result of traumatic lesion or contusion of the artery. Its pulsations were visible to the eye, isochronous with those of the wrist, and the artery could be distinctly traced up to the tumor. Strong pressure below the tumor upon the artery suspended the pulsations in it, and reappeared as the pressure was removed.

On the 10th September, M. Pétrequin publicly applied the electro-

galvano-puncture to the tumor, by introducing two fine sharp needles into it, to the depth of about two centimeters, giving them a direction at right angles to each other. He then made their heads communicate with the poles of a pile. At the first contact, there was an electric shock and acute pain, which symptoms went on increasing in proportion as he augmented the dose of galvanism. At the *fifteenth* these symptoms were extremely intense, and the surgeon then ceased. The duration of the operation of the transmission of the fluid was not, however, ten to twelve minutes, during which he changed the direction of the galvanic currents three times. While operating, the surgeon himself perceived that the pulsations were diminishing, as was confirmed also by Drs. Girin and Rambaud, who assisted at the experiment. What was the delight of M. Pétrequin, when he found they had entirely ceased at the end of the sitting. "The *aneurism with isochronous pulsations*, says the surgeon, was replaced by a *solid and indurated tumor*. The problem was solved. I removed the pins, and the dressing consisted of compresses wet with fresh water, and sustained by some turns of bandage." The patient returned to his bed himself; two hours after suffered no more, and in the afternoon ate his usual meal. M. Baumers (interne) has drawn up a minute description of the case.

On Sept. 12th, the tumor was found to have disappeared; not the slightest pulsation existed; the temporal artery, immediately above it, [the word is *en-dessous*—a mistake, undoubtedly, for *en-dessus*. T.] was obliterated, as no pulsations were observable, whereas they were very evident in the course of the vessel below. On the 20th of Sept., the nodule (noyau) which had succeeded to the tumor was nearly absorbed, no longer rose above the skin, and was destitute of all pulsation or pain. M. Bouchacourt also confirmed these facts. Eight days after, the cure remained complete. The surgeon insists on this experiment on man being more conclusive than those from vivisection.

In two other experiments on aneurisms, one on the ophthalmic, the other on the brachial artery, the results however were incomplete. M. Pétrequin will give new details, and the rules and method he deems the best, in his proposed new work *Mélanges de Chirurgie*. As it is, it is a wonderful triumph for electro-puncture.

The more and more as observations are gathered upon the important subject of *thoracic and sub-sternal aneurisms*, the more do we find the rage which has existed for some years for auscultations of the heart, and the aorta and its trunks, receding and retrograding before the truths which this very ardor of investigation has disclosed. The more arguments also do we thus obtain for falling back for the honest truth in these matters upon such great practical observers and surgeons as Dr. Mott himself, whose illustration of the fallacy of the fashionable (not always *unprofitable*) modes of diagnosis, as seen in his valuable chapter on the subject of Aneurisms, &c., in this volume, is another striking proof of the necessity of relying for the evidences of *commencing* aneurisms in

the great trunks in the thorax, (and which is the only period when medical aid can avail) upon such broad, clear, and common-sense manifestations as are to be derived from a thorough knowledge of the general laws which govern the animal economy in health and disease.

One of the latest writers on this subject, Dr. A. Pereira, (in a Memoir on Aneurisms at the arch of the aorta, and on the diagnosis of commencing aortic dilatations, (in the *Archiv. Gén. de Méd.*, Paris, Juillet, 1845, 4e série, tome VIII., p. 305—326,) confesses himself compelled to come to the following conclusions: "At the present day, numerous observations are found in the annals of science, and most of those which have been collected for thirty years past, are as remarkable for the precision of the diagnosis as for the rigorous (minutiense) exactitude of the anatomical researches. We may, however, ask ourselves the question, in comparing the epoch of Morgagni to our own, on the *real value of the progress* of science, whether we have not *lost on one side what we have gained on the other*? Are we not, since the exact methods laid down for auscultation and percussion, somewhat neglectful of an enumeration of the occasional causes and general symptoms so well grouped by this great observer? If it be true to assert that from those powerful resources, the diagnosis of internal aneurismal tumors,) is no longer left to the uncertainties of an obscure pathology, it is equally so to add, that we too often lose sight of the *physiological changes produced upon the organization* by the mysterious action of the dilatations of the heart in its commencing process, and which is then inaccessible to the physical aids of diagnosis. When the evil has augmented in the dark, and the aortic dilatation acquired a considerable volume, and the walls of the artery become attenuated, and the neighboring organs profoundly altered by a continued pressure, the man of art sees himself reduced by a very exact but tardy diagnosis, to pronounce that the cure is hopeless. I am of opinion, therefore, that *modern discoveries*, in other respects so precious and so glorious for our epoch, have made us forget, in some degree, the lessons of our predecessors. Yet what *useful instruction* might we not yet obtain from the writings of Valsálva and Albertini, who KNEW HOW TO RECOGNIZE AN ANEURISM OF THE AORTA WHEN IT HAD YET MADE BUT LITTLE PROGRESS, (Morgagni, *De Sed. et Caus. Morb.*, Epist. 17,) and who had even laid down the treatment proper to be pursued for it." (*Loc. cit.*, p. 305-6.)

Continuing his reflections, and furnishing in illustration two cases of aneurism of the arch of the aorta at the Hôtel Dieu, Dr. Pereira shows that in both (as the symptoms and autopsies proved) the great and important sign, palpable to the eye, of the *arched form* (*la voussure*) of the walls of the chest, the *matité* (obtained by percussion) and the various *bruits*, (*bruit de souffle*, *de frottement*, *battement simple*, &c.,) though all clearly demonstrated, were precisely such as the present received and much *bruted* modes of auscultation, percussion, &c., exhibit no evidences

of whatever in the commencing or formative stage of the disease, the only time when medication can be relied upon with a hope of cure. "Such (says Dr. Pereira, in conclusion,) are the different physical signs having their currency in science at the present day, and the simple enumeration seems to me to triumphantly demonstrate their insufficiency."

While on the other hand he points out with much force the carelessness with which a most important, constant and idiopathic symptom, (as such men as Morgagni, Mott, &c., have thought or think it to be. T.) viz., that of syncopes, faintings, and *swoonings*, (too trivial, nervous and palpable apparently, alongside of the stethoscope,) has been entirely overlooked. Thus how often does sudden death occur after their frequent repetition, and yet enormous aneurisms have been found, and without rupture or extravasation.

Dr. Pereira very ingeniously supposes that these symptoms might possibly sometimes be re-produced by the fibrinous clots which had formed on the walls of the aneurism (and the production of which clots the retarded course of the blood in these syncopes manifestly favours) becoming detached and drawn into the general current, and suddenly interrupting the course of the blood to the brain, by momentarily plugging up (tamponing, as it were,) the embouchure of the brachio-cephalic trunk, or that of the left carotid.

[As an illustration corroborative of the intimate and idiopathic connection of the symptom of *syncope* with arterial aneurismatic lesion, we may instance a case that fell under our observation, in which an aneurism of great extent, apparently connected with the renal artery on one side, and which had been of some duration, first indicated its existence by a sudden syncope succeeding, as it would seem, to rupture of the sac from violent muscular exertion. Fainting fits continued for several days, with extreme restlessness, and walking the room, and alternately lying on the bed, till death suddenly succeeded one of these turns of exhaustion. The patient was about 30 years of age, of small make, short stature, sanguineous, energetic temperament, and remarkable muscular strength. On examining the body, about one quart of coagulated blood, of the exact appearance of fine *currant jelly*, was found between the intestines and the peritoneal lining of the anterior wall of the cavity of the abdomen, and about half a gallon of black liquid blood in the neighborhood of the spine and arterial lesion. T.]

On the subject of *atheromatous* and *steatomatous morbid degeneration in arteries*, Mr. Gulliver (*Medico-Chirurg. Transactions*, of London, 2d series, Vol. VIII., p. 90) has, from much investigation, come to the following conclusions:—

1. The white or yellowish red plates, on the internal coat of arteries, are of a fatty nature.
2. The soft matters between the internal and middle tunic, and which are usually considered *ætheromatous*, are also of fatty formation.

3. Fatty matter is often found also in the substance of those coats, even when they are ossified.

4. The fatty matter is generally constituted of cholesterine and oleine, and sometimes also of margarine.

Mr. Gulliver has also found fatty accumulations in the testicles, in gangrenous and inflamed lungs in aged persons, in the liver in phthisical subjects, and in children in various diseases.

On concluding his interesting experiments on living animals and dead subjects, in illustration of the nature of *traumatic lesions of arteries*, (even those of the carotid, &c.) and their *spontaneous cure by a plugging clot*, (caillot obturateur,) M. Amussat, (*Arch. Gén. de Méd.*, Paris, Juillet, 1845, p. 372, 373, 374,) has arrived at the following deductions, in addition to those we have given in our notes in the text, under arteries:—

1. That this clot, even in large transverse wounds, forms very rapidly, and under the eyes.

2. That it is composed of the fibrine of the blood, and supported by the *external cellular* (or *fourth*) coat of the artery, and not by the *sheath*, as some suppose.

3. The central cavity of the clots resembles that of *sanguineous tumors*, as described by the author, and serves as a diagnostic character to discover an artery masked by a clot.

4. That the clot, (contrary to the views of Jones, Béclard, &c.) is formed by the artery itself, is proved by its being found on the end of the vessel, where it comes out beyond the level of the wound.

5. The clot is the more voluminous and resisting in proportion as the artery and its cellular coat were more tense at the time of the section. Hence, says M. Amussat, the practical deduction from this fact, that *before dividing arteries, we should make a strong traction upon them*, in order to give them the best chance of forming *solid* clots like those seen in wounds from *avulsions*, [of limbs, &c., (arrachment).]

6. When both carotids are divided at the same time in a living animal, without wounding the spinal marrow, *clots always form on the cardiac extremities of those vessels*, and these are always in direct relation with the greater or less degree of tension of the neck and vessel at the moment of the section. On the contrary, if the section is made one or two minutes only after the destruction of life by the section of the spinal marrow, strangulation, asphyxia, &c., there is no clot produced at the cardiac extremities of the carotid, or if it is formed, it is very small and resembles in no respect those which are found in animals, who die directly from hemorrhage. [This fact, as suggested by M. Amussat, might if fully verified, become one of great importance in a *legal* point of view. Thus in murder, *committed* where the crime is attempted to be concealed by the murderer cutting the throat of the deceased afterwards, so as to make it appear that the victim had committed suicide. The more so as the murderer in such cases usually overreaches himself by severing the tissues of the neck down to the spine, far more effectually than the person himself usually does, so

that a thorough division of the carotids, as well as vertebrals, perhaps would be thereby effected. T.]

7. The eardiac extremities of the divided arteries are then the point the most important to be observed, since in examining them with attention, we may with more certainty than by an inspection of the soft parts recognise whether the vessels have been divided during life or after death.

The last information posted up on the subject of surgical operations for *varicocoele*, we find given apparently with much impartiality by Dr. J. Hélot, (*Arch. Gén. de Méd.*, Paris, Juillet, 1845, 4e série, tome VIII., p. 287-304. See also a notice in the text of this volume of another interesting memoir on this subject in the same journal, 1844, &c., by this author,) who, after all his researches, appears like most other surgeons to have come to the conclusion to reject all the varied modes and processes devised, by constriction of the veins, whether sub-cutaneous or otherwise, exsection of the scrotum, &c., as too dangerous, and too often followed by a return of the disease, which upon the whole, it is conceded, had better, since varicocoele is but seldom a formidable affair, be consigned to a properly constructed suspensory bandage, [See one devised by me, and used with great effect at the Seamen's Retreat, New-York, described with a Plate in our Vol. I. T.] It is certain, M. Hélot says, that both M. Ricord and M. Velpeau have had occasion both to lay aside their former processes, and substitute others, or make use of none but the suspensory. The latest method in vogue at Paris, or that of enroulement, or rolling up the veins on a sort of miniature capstan or windlass, as modified by M. Vidal, is deemed by M. Hélot to be equally unsatisfactory and fruitless with the others. Nevertheless, M. Vidal, in the short space of time since he adopted it, has already operated upon eighty cases. But it will require years perhaps to determine in how many of these the disease shall have been radically cured, and without a return.

Among the new *medicinal resources* proposed for the cure of neuralgia, and which conservative surgery would now substitute for the surgical operation of dividing or exsecting the affected nerve, (a means generally abandoned at present,) we perceive a *watery solution of the extract of tobacco*, which Mr. Gower (*London Lancet*, 1845) has used with great efficacy in several cases, one single application of it assuaging the lancinating pains immediately.

A modification of *amputation at the knee-joint immediately above the condyles*, so warmly insisted upon by Mr. Syme, (See our notes under amputation in this Vol.,) has been proposed and found to answer excellently well by Mr. Fergusson, at King's College Hospital, London. In a case aged 24, where the left knee-joint had been for a length of time enlarged, with abscess and more or less pain on moving the joint, Mr. Fergusson made a transverse incision in front above the apex of the patella, then plunged his knife transversely in front of the ham-strings, cutting out a long thick flap from the calf, which, after dividing the femur close above the condyles and patella, was brought up into neat coaptation in front, healing nearly

all by first intention, and forming a capital stump. The surgeon of London was led to this modification after having made up his mind to give Mr. Syme's favorite place for amputating the femur below, a fair trial. It certainly strikes us as one that will prove useful in such cases. Difficulties were found, however, in securing the popliteal artery from the morbid alteration and condensed hard character of the tissues around it. Mr. Fergusson considers Mr. Syme's arguments, (which we have stated in the text,) in favor of this amputation as evidently well founded, to wit, the less danger of inflammation and necrosis in the spongy condyles, than in the solid shaft, and also avoidance of the danger of dividing through the joint itself. It is become an axiom also, as Mr. Fergusson says, to excise no more than necessary, as is seen (See our notes) in scooping and trephining out the carious part only of joints, small bones, shafts of long bones, *i.e.*, what is degenerated, and no other portions in other words, *pro hac vice*, and no more, (See *London Lancet*, July, 1845, p. 79.)

Flap Operation in Amputations.—Mr. Fergusson (*Pract. Surg.*) invariably recommends the flap operation of Lowdham, (claimed as one of *British* origin.) So also do Messrs. Liston, Lizars, and others educated in the Edinburgh School. Sir George Ballingall, equally favorable to it, does not concede all the advantages claimed for it, nor coincide in the censures cast upon the circular incisions. In the Edinburgh hospital alone, over 400 amputations by the flap method were performed he thinks, in the space of twelve years.

Rapidity of execution, and a far better and more fleshy and less cutaneous cushion to the stump, are two of the great advantages of the flap method. But the latter result may be obtained in the circular, by giving a slope to the incisions from the divided edges of the bone to the surface.

In thick muscular parts as at the deltoid and calf, the flap mode is objected to as giving too large a cushion; but whether by the circular or flap, this redundance disappears and the end of the bone is ultimately left in both cases with a similar covering, *i. e.*, condensed cellular tissue, which forms the best stump. Non-union, suppuration, exfoliation, protrusion of bone, tumors on the ends of the nerve, &c., are as common after the flap, as after the circular operation.

Sir George Ballingall, after his extensive experience, confesses that it is difficult to relinquish the flap operation after having once been in the habit of performing it, because it presents facilities so much greater than other processes.

Dr. W. Philson, (*London Lancet*, October 1845, p. 429-430,) shows by a successful case of his of a boy with *complicated injury to the humero-tibial articulation*, dislocation of the ulna and radius backwards, and the articulating extremity of the humerus, driven forwards through the skin and muscles in front, and denuded and protruded to the extent of an inch and a half, laceration of the capsular and lateral ligaments, and the coronoid process of the ulna and external condyle of the humerus fractured, that even here the ves-

sels and nerves being uninjured, there was no necessity of exsecting the protruded humerus; the surgeon having effected a perfect cure by replacing the parts, and dressing lightly with straps of adhesive plaster loosely attached, using cooling lotions and keeping the arm flexed on a pillow, *i.e.*, by the *mild and gentle* treatment which is now justly in vogue in these severe injuries and which has recently procured such remarkable restorations in similar cases. (See our notes under *Amputations*.)

Exsection of the Jaws.—Mr. Liston, (*Lond. Lancet*, Oct. 26, 1844, p. 121–122,) speaks of tumors of the upper jaw which involve all the parts, and are unbroken on the surface, as they are covered by an expansion of the membrane of the mouth. There are, however seen upon them mammary or botryoidal, *i.e.*, nipple-like processes. They are insensible, and do not bleed, and are quite different from medullary tumors here—but they do not destroy life.

Mr. Liston says he takes no credit for removing the jaw, which he states has been performed by *Gensoul, Lizars, Syme, and others*; but I take credit, says this surgeon, for *correcting the diagnosis in these cases, and for having pointed out the manner, in which an operation could be performed with safety and success*. In the cases operated upon (he continues,) by the gentlemen to whom I have referred, the disease almost uniformly returned. It was of a malignant character. In such cases, from the great vascularity, there is fearful hemorrhage in removing the tumor, especially if you leave a portion of it behind. He mentions a case where both carotids were tied, (one the external,) but such was the bleeding, that the surgeon had to leave the operation unfinished. When the tumor is confined to the boney cavity only, you may operate, but it is madness otherwise, especially if the tumor fills up the nostril. It will not do to remove the fungous portion of the tumor in the antrum only, for the disease will return and end fatally, as in one of his cases; but you must, he says, take out the whole of the upper jaw containing the tumor, and this at an early period.

There is another kind of tumors, which may be exsected in this manner, with scarcely the least hemorrhage. But these also will bleed if cut into; therefore they might be removed entire.

In one case M. Liston from the size of the superficial veins, was induced to remove a portion of the skin, but regretted it.

His *process* is this, for the upper jaw: to uncover a large tumor, he makes an incision outside of the zygoma from the point of the cheek bone to the corner of the mouth, and another from the angle, (inner ?) of the eye to the middle of the upper lip.

If the tumor is of moderate size, you are, he says, to cut from the angle of the eye, and bringing the incision down under the ala of the nose, you divide entirely through the upper lip at the median line of the columna; then make another shorter incision from the same point, (*i.e.*, inner angle of the eye ?) along under the eye in the course of the fibres of the orbicularis palpebrarum muscle, to the zygoma, by which you dissect up a large flap which is to be turned backwards and outwards, after which you exsect the bones.

So little is the bleeding after you have turned the tumor out, that you scarcely have a vessel to tie.

Mr. Liston says he has *extirpated the upper jaw* to remove fibrous tumors *nine or ten times*, and without losing a single patient, and he has also performed the operation for a case of *erectile tumor*, displacing the upper and lower jaw.

Malignant tumors in the lower jaw, requiring an operation, generally commence in the parts exterior to it and involve it. *Cancerous* tumors here are not to be meddled with.

Mr. Liston deprecates the *fuss, and hue and cry*, which has been made about removing such tumors; one gentleman he says, published that he had removed the *whole of the lower jaw*, which proved an entire mistake.

There are tumors of the lower jaw which commence in the bone and speedily throw out a fungus; these are not to be meddled with.

For another kind growing within, and separating the plates of the lower jaw, and sometimes composed in part of cysts, containing a glairy fluid, he has removed one half the jaw with disarticulation. He has also felt justified in removing some tumors of the lower jaw, which contained nevertheless, some fungous growths. [See above our account of an exsection, at Newark, New-Jersey, by Dr. Mott.] In one of these the disease had not yet returned, though 4 or 5 years had elapsed. In this case nothing but the ramus of the left side remained.

Other tumors of the lower jaw are of solid bulk, composed of bone and cartilage of only two or three years' growth, or of greater age, and then attained to a monstrous size. These may be removed. It was Mr. Cusack, Mr. Liston thinks, who led the way in operating for such tumors. [We would remark here, that it is this erroneous expression of Mr. Liston, which has induced Dr. Mott to address to that surgeon the letter which will be found in the conclusion of this Vol. T.] The operation for these is, Mr. Liston thinks, full as justifiable and successful, as for amputations of the limbs. For these great operations, Mr. Liston recommends precisely the process of the curvilinear incision, brought up at its termination upon the symphysis, &c., precisely as first established by Dr. Mott. (See this Vol., under Exsections—also Baker's case—Preface of Dr. Mott, to Vol. I.) At the symphysis, however, he thinks you need not saw entirely through, but complete the section with the cutting forceps. In laying hold of this end of the exsected bone, you are to take care in some of the cases that you do not break it. The articulation is if practicable to be opened in front. This also, is Dr. Mott's process. In some cases Mr. Liston thinks this is impossible. If, for example, you break the fragment from behind, you are then to seize it with a strong forceps, and open the articulation, twisting this portion inwards and forwards, by which you more readily detach the temporal muscle from the coronoid process. Mr. Liston after bringing the flap down, applies in a few hours, cold pledgets and unites by the twisted suture. Herein Dr. Mott pursues an-

other course. (See our description of his exsection of Baker's jaw in the conclusion of this Volume. T.]

In *exsections of the lower jaw*, we perceive that M. Blandin of Paris, (*Arch. Gén. de Méd.*, Juillet, 1845, p. 368, 369,) has recently performed this operation successfully in a female, after removing the whole left ramus and a portion of the body of the jaw, as far as to a line with the commissure of the lips on the opposite side. He managed to preserve the principal branches of the facial nerves, and thus avoided paralysis of the muscles of the face.

The *exsection of both the upper jaw bones* is stated (*Jour. für Chir. und Augenheilkunde*, 1843-44, *Gaz. Méd. de Paris*, Mars 15, 1845, p. 169) to have been performed at Erlangen, by M. Heyfelder. The patient was aged 25, and the tumor, which occupied the vault of the palate, increased so much in a year as to invade the two upper maxillary bones, crowding the nose upwards, compressing the tongue, and interfering with deglutition and respiration. The incisions were made from the outer angle of each eye to the corresponding commissure of the mouth, and the teguments of the whole face included in them turned upwards on the forehead. The maxilla on each side was sawed at the zygoma and from the bones of the nose, &c. The vomer being then divided by strong scissors the parts exsected with the tumor were soon extracted. The wound was united by twenty-four sutures. The operation was performed July 23d, and on August 25th the patient quitted the hospital, cured.

A recent case is related by Mr. French, (*London Med. Gazette*, 1845, also *London Lancet*, September, 1845, p. 352,) in which *Anchylosis of the lower jaw* had existed from infancy up to the age of 22, when the patient died of apoplexy. He had taken his food through an opening made by the removal of several of the incisor teeth.

In this case no attempt appears to have been made to overcome the immobility, and the post mortem disclosed a thin osseous lamellated plate or expansion of the left ramus extending upwards and uniting by intermediate cartilaginous substance only, with a corresponding lamella from the upper jaw.

Here was a case in which a cure, as Mr. French hints, could undoubtedly have been readily effected, if the true locale and character of the anchylosis could have been accurately diagnosed, as certainly could have been done with equal facility by a careful inspection.

It shows how thorough and searching the manipulating examinations should be in such cases, and how intimately conversant every person who undertakes to practise the noble art of surgery should be with the minutest anatomy of relation in disease as in health. A mere division of the cartilaginous union and the screw-lever of Dr. Mott, which we shall give in the next volume, under his celebrated operations for *immobility of the jaw*, would have been all that could have been required.

A large central portion of the *clavicle* which had been necrosed from syphilis and fractured into two portions, the sternal fragment riding over the acromial, was successively exsected and extracted by its two fragments, (the sternal first,) by M. A. Asson, (see *Giornale dei Progressi*, August 1843, *Arch. Gén. de Méd.*, Paris, July, 1844, p. 374-5-6.)

In cases where *exsection of the head of the femur* could be substituted for amputation at the hip joint, Mr. Guthrie and Sir Geo. Ballingall are disposed to give it a decided preference.

Mr. E. Bonino (*Braithwaite's Retrospect*, Vol. X., July to December, 1844, p. 136, etc.,) relates *twelve* cases of this kind, *five* of which were perfectly successful. The cases in which he recommends it are:—1. Dislocation with protrusion of the head of the bone through the soft parts, which it is found impossible to reduce. 2. Gun shot wounds involving the upper part of the bone. 3. Caries of the upper part of the femur, whether primary or secondary. In the last case there is doubt as to its propriety, as it is impossible almost to say if the cotyloid cavity is involved or not. If it should be, the operation would be worse than useless, and some of Mr. Bonino's fatal cases are supposed to have resulted from this implication. (See also *Northern Journal of Medicine*, August, 1844, p. 278.)

In relation to a difficult point, that of the *diagnosis of dislocation of the head of the Femur into the Ischiatic Notch*, Mr. Syme, (*Provincial Med. Journal*, June 24, 1843, p. 260,) speaking of this form of dislocation of the femur, in which there is less displacement and fixture than in any other of the head of this bone, and in which greater obscurity ensues from a slight degree of extension only, causing the shortening and inversion to disappear, considers the most diagnostic and permanent feature, and one which is not found in any other injury of the hip joint, whether dislocation, fracture or bruise, to consist in an *arched form of the lumbar part of the spine which cannot be straightened so long as the thigh is straight, or in a line with the patient's trunk*. When the limb is raised or bent upwards upon the pelvis, the back rests flat upon the bed; but as soon as the limb is allowed to descend, the back becomes arched as before.

On the subject of *diseases of the articulations*, which figure so prominently in this volume, we have not had an opportunity in time to avail ourselves of much valuable matter on this head which might have been extracted from a recent work of M. Bonnet of Lyon, (*Traité des Maladies des Articulations*, Paris, 1845.) We can barely allude to a few of its more important details and principles. M. Bonnet considers all morbid productions whatever, which are found in the tissues about the joint or in the joint itself, whether false membranes, fungosities, fibrous, lardaceous, cartilaginous or osseous, to have been formed from successive transformations of the original secretion and organization of plastic or fibrinous lymph effused in the depth of the tissues in consequence of inflammation.

The same author inclines to the opinion that the cartilages of in-

crustations are un-organized and analogous to the cartilages of the teeth and to the hair.

In the treatment of ankylosis, he insists with great force upon three points: 1, a proper position—often the reverse almost of the defective one the patient would instinctively prefer; 2, immobility; 3, after a certain time gentle movements upon the joint; 4, the apparatus should be one of his *gutters of iron wire*, as we have described above, for fractures of the neck of the femur.

The author is led from his experiments on the dead subject, in illustration of the manner in which tractions or sprains, or entorsions of the articulations, act in producing fibrous, muscular and osseous lesions in those parts, to commend in strong terms, as a powerful curative means, the employment of *massage* (a species of kneading or *shampooing*) in cases of chronic arthritis.

In the decomposition of the pus of abscesses in joints, and which is favored and aggravated by the admission of air and the difficulty of eliminating this contained fluid, M. Bonnet finds another prolific source of what M. Bérard denominates *putrid infection*.

He considers, with M. Malgaigne, that Hey's disease of *luxation of the semi-lunar cartilages* of the knee-joint, is an incomplete luxation of the articulation. The editors of the *Archives Générales de Médecine* (Juillet, 1845, p. 383,) however, differ from M. Bonnet in the supposition of the latter that in this luxation the inner condyle of the femur passes behind the fibro-cartilage crowded in front.

It is gratifying, in conclusion, to find that the views of M. Bonnet, on many diseases of the articulations (as white swellings, &c.) which were formerly deemed curable only by amputation, go to confirm those that we have endeavored constantly (in this work) to enforce; to wit, the substitution of a more efficient internal and external therapeutic, either by internal constitutional treatment or external medication, or both, in lieu of surgical mutilation of the body, thus sustaining the more humane system now coming into just repute, viz., that of *conservative surgery*.

An Improved Fracture Cot for Sea-service.—Dr. Foltz, surgeon of the U. S. navy, in the memoir to which we have already favorably alluded, gives an account of a new arrangement for the *treatment of fractures at sea*, which is one of his invention, and which by the description he gives, and the favorable results obtained from it, should be generally known. We extract, therefore, with pleasure his account of this contrivance, as given in his memoir in the *New York Journal of Medicine*, before quoted, (1843.)

The other case of comminuted fracture occurred in the person of a seaman who had been on shore on liberty. Having been taken in charge by an officer, who was endeavoring to bring him on board, he threw himself over a precipice nearly forty feet in height, the officer himself narrowly escaping being carried with him. Fortunately he landed on a tiled roof beneath, which, giving way, broke the force of the fall, or he would doubtless have been instantly killed. He was conveyed to the hospital; and here, upon exami-

nation, it was discovered that the left tibia was fractured near the ankle-joint, and also two of the ribs on the right side as well as the clavicle. The body generally was much bruised; and in addition to these ills, he was laboring under delirium tremens. The fractured leg was placed in Desault's apparatus, and tied down to the cot. Venesection $\frac{3}{4}$ xvj. and tinct. opii et assafœtidæ were ordered. During the first twenty-four hours after his admission, he suffered greatly from delirium, and much force was necessary to prevent his moving the fractured bones; but after that, he became more tranquil, which was followed by a sound sleep; and thus we were enabled to direct our attention to a more perfect adjustment of the fractures. On the fourth day he was placed upon the fracture-cot, which we invariably use in all cases of fracture of the lower extremities, both at sea and in hospital practice; but it is for the treatment of fractures on board ship that we were led first to construct it; and for this it is peculiarly adapted. Bandages and compress were applied to keep the ribs and clavicle in their proper position; and this was readily accomplished, as the patient was necessarily confined to the horizontal position. No apparatus can, indeed, so well adjust the fractured extremities of a broken clavicle as the method here pursued; and from this time, until the entire recovery of the patient, not a single unfavorable symptom was presented, notwithstanding the existence of four fractured bones, and the extensive injuries in other parts of the body. Dr. Foltz continues, on treatment of fractures at sea:—This constitutes one of the most critical, as well as one of the most frequent duties of the naval surgeon; and almost every one who has had the treatment of such cases on board ship, has doubtless had the painful and disagreeable duty devolve upon him, to re-adjust the fracture—an event that no care on his part or that of his patient can prevent. Not unfrequently, after the greatest vigilance and care, the naval surgeon has the mortification to find that the cure is not so perfect as it should be; and these *opprobria medicorum* of the naval surgeon are often brought up in judgment against him, by those who know but little of the countless difficulties encountered in the treatment of fractures at sea, especially in gales of wind, when those with sound limbs are unable to keep their feet, and the knees and timbers of the good ship herself are groaning and tearing asunder, as she sports about on the mighty waves. We have witnessed cases of deformity which had been treated by surgeons, whose eminence and reputation are a sufficient guarantee that everything had been done which judicious and careful attentions could effect toward preventing these unfortunate results. In a case, therefore, of so much difficulty, and one of such frequent occurrence, it is with no ordinary pleasure that we are enabled to recommend to the profession, as well as to all those “who go down upon the sea in ships,” a fracture cot, which will effectually guard against all accidents from displacement. This apparatus, as represented in the lithograph facing the title-page, must, from its many advantages, and especially its simplicity, recommend itself to the profession. We

are gratified in being able to add that such of our naval surgeons as have seen it in use, give it their highest approbation; and moreover, that it has met with the warm approval of several of the most experienced surgeons in the British and French service, by whom, when the apparatus was in use, it was carefully examined.

The apparatus consists of an ordinary ship's cot, eight feet long and three feet six inches wide, without sides. On the centre of this cot, the mattress and bedding of the ordinary size are to be made up, excepting the sheets and pillows; the head of the mattress is to be kept near to the head of the cot; and thus will be left a space of two feet between the lower end of the mattress and the foot of the cot. Over this, a large cot-frame or stretcher, also eight feet by three feet six inches, is to be suspended, by means of a tackle, as is seen in the plate. The canvass covering this frame is to have a hole, three feet and a half from its head, for the use of a bed pan; and on this frame the sheets and pillows are to be placed. Upon this moveable stretcher the patient remains throughout the treatment.

As this frame can be elevated or depressed at pleasure, every necessity can be attended to without the least motion on the part of the patient. The cot may be daily removed, aired, or changed, which is so frequently necessary in warm climates; and thus can cleanliness be more perfectly preserved than by any other method; while the fracture is at no time disturbed. When lowered down, the mattress beneath, upon which the patient rests, should always be within the frame of the stretcher; and this, by the way, is the only point necessary to guard against in the use of the cot; but its whole construction is so simple, that every fore-castle-man will be able to make one.

Fractures at sea are displaced in consequence of the limb or splint coming in contact with the sides, or end of the cot, during the pitching or rolling of the ship, or in moving the patient while using the bed pan. This fracture cot, however, is without sides, and the end is never touched; a slight pull upon the tackle will elevate the patient without any effort on his part, at the same time that the whole body moves together; and whether he is resting in the cot upon the mattress, or is suspended over it upon the stretcher, he always moves free in space, with the motion of the ship, without any occasion for muscular exertion. Our limits will not permit our going farther into the merits of this invention, but its simplicity and usefulness will always be its best recommendation. Indeed, a fracture cot of this description should at all times be ready on board our ships of war, and on our excellent and incomparable European packets.

In regard to the necessity, recently urged by M. Guepratte, (*On Wounds of Bones*, *Annales de la Chirurgie*, Paris, Avril 1845, and *Arch. Gén.*, Juillet, 1845, p. 354-5,) of more accurately defining and treating *wounds of bones*, as distinguished from those of soft parts, whether they are by cutting, blunt, or pointed instruments, or chemical agents, &c., or on flat, long or short bones, or merely fractures; he maintains that those from cutting instruments are

more dangerous, more disposed to necrosis, and longer in consolidating, than those of fractures, because the osseous fibres and molecules in the former are directly compressed and condensed, but in the latter only bent or deviated from their natural elasticity. The extraordinary case, however, we have noticed below, of a sharp chisel, embedded *five* inches obliquely transverse into, and through the dorsal vertebræ and spinal marrow, and the rapid cicatrization of the wound, without even suppuration, and followed by almost total restoration of the paralyzed limbs, &c., to their normal functions, is a strong case in point, in total discrepancy with M. Guérin's doctrines.

M. Guérin, of Vannes, (*Arch. Gén.*, Mai, 1845, p. 33, &c.) has given some new directions for treatment of certain difficult fractures, and especially *fractures of the clavicle*, which appear to possess a good deal of force. While according his approbation to the great advances made in this part of surgery by Desault, in recommending the dressing to be applied in such way as to give a direction upwards, backwards, and outwards, to the acromial fragment, justly as we think, points out the error of all surgeons, from Hippocrates to the present day, in attaching too much importance to this fragment, and in its traction downwards by the weight of the shoulder, and in overlooking the great *mobility* of the *sternal portion*. This he shows has a movement from before backwards and the reverse, and especially a more important one from *below upwards by the traction* of the clavicular portion of the sterno-cleido-mastoideus muscle, and which is greater in proportion to the *extent* of the insertion of that portion of that muscle—for example, greater in robust persons and less so when the insertion is nearer to the sternum. Hence, the riding of the fragments in transverse fractures is greatly owing to the mobility of the sternal fragment, apart from those exceptions where there is an *oblique fracture* of that character which places the acromial above the sternal fragment.

All bandages however in use, and that of Desault included, are defective, this surgeon says, in preventing the ascent of the sternal fragment, while the figure of 8 has the preference from giving more or less fixity to the sound shoulder. Even the starch bandages, he says, do not prevent the movement upwards of the sternal fragment.

M. Guérin then lays down these rules:—

1. The diseased shoulder should be carried upwards, outwards and backwards, for which purpose we are to use Desault's bandage and the starch bandage associated with it.
2. The thoracic limb of the opposite side is to be fixed to the chest so as to prevent its movement.
3. To prevent the contraction of the sterno-mastoid muscle on the sternal fragment, the face of the patient is to be kept turned towards the fractured side by means of starched bandages embracing the head and diseased shoulder, by which the muscle (sterno-cleido-mastoid) is *maintained in a state of relaxation*.

The inconvenience to the patient is, that he is deprived for a

month or more of all movements of the upper part of his body. But for the sake of a uniform consolidation, most persons will readily submit to this treatment.

The treatment seems judicious with this exception, that the *starch* bandage should never in any case of fracture whatever be applied until all symptoms of inflammation have passed off, *i. e.*, after the lapse of three or four days—this case of the clavicle being perhaps the only one in which it is sooner admissible.

The same surgeon, in continuation of his observations on fractures, (*Op. cit.*, *Archiv. Gén.*, 4e série, tom. VIII., June, 1845, p. 154, et seq.) has made some new and interesting pathological researches, touching the mooted subject of *fractures of the neck of the femur*. In these fractures which he found with M. Rodet were most readily produced on the dead subject, (as they are probably on the living,) by a blow (a true *contre-coup*) on the heel while the leg is being extended on the foot, he proves conclusively, as he thinks, by his colored injections (after tying the femoral generally on a line with Poupert's ligament, and above therefore the giving off of the nourishing artery of the femur) into the aorta just above its terminating bifurcation, and also into the obturator, (which furnishes a branch to the reddish adipose tissue at the bottom of the cotyloid cavity,) and into the ilio-lumbar, (which furnishes the principal nourishing branch to the ilium,) and also finally into the gluteal artery; that the head of the femur and its connecting fragment of neck may thus, contrary to received opinion, obtain an ample supply of blood to form a true callus directly from the arteries of the ilium through the bottom of the cotyloid cavity, and the round ligament which connects this cavity with the head. Hence he seems to doubt the opinion of Sir A. Cooper, (deduced by that surgeon from an examination of 44 subjects, or specimens with fractured neck of the femur, in which not one had united,) that these *intra-capsular* fractures never consolidate. Inclining to the more favorable opinion of Bichat as to the supply of vascular nourishment by the reflected duplicature of the capsule upon the head and neck, constituting a substitute for a periosteum, M. Guérin doubts also the explanatory theory of Sir A. Cooper to account for alleged ununited intra-articular fractures generally, viz., the more abundant secretion of synovia caused by the irritation of such fractures, whereby the capsule becoming distended, keeps the edges of the fragments of bone too far apart to be kept in coaptation. Most usually as is well known the union of the fragments of the neck of the femur within the capsule, is made by an intermediate fibrous tissue, which at least so far we ourselves should consider to be proof positive of an active supply of arterial plastic nutriment to those parts.

M. Guérin refers to the astonishing results of anaplastic restorations by the narrowest pedicular attachments, which have necessarily left only a very slight vascular connection; and remarks, also, that were there really the defective vitality in the femoral neck generally supposed, there would have been found one case at least of

necrosis in such fractures, the same as gangrene of the soft parts is found where anaplasty fails. But an instance of necrosis in the neck of the femur, it is asserted, has never been found. [Was not, however, that of Dr. Batchelder, cited above, one of this description, ending in a necrosis and total separation of the entire neck and head? T.]

The same surgeon has noticed the curious fact, in support of his experiments, (above,) that, in examining ancient non-consolidated fractures of the neck of the femur, he has always found the round ligament in a remarkably high state of vascularity, and its vessels greatly dilated. It is then the mobility of the fragments and the difficulty of maintaining their coaptation which he deems to be the chief obstacle to osseous union in these intra-capsular fractures of the neck of the femur, and the chief cause of the formation of an intermediary fibrous ligament as the substitute.

In the treatment of these fractures, which is after all the most important point, M. Guérin discards the processes of Desault, Boyer, &c., and the inclined planes, &c., of others, and prefers to make extension by cords, (lacs,) one embracing the upper part of the thigh, and to be attached to the head of the bed; the other to fix the foot to the foot of the bed. This is the mode lauded by Heister, and generally employed in the time of Petit, and now revived by M. Jobert, (de Lamballe,) who makes this extension less painful by adjusting the lower cord to a leather shoe. The great point is to prevent the transmission of movements of the pelvis to the fragments of the fracture, and consequently both limbs should be kept in an immovable state. The customary modes are precisely such as would be adopted to keep up the mobility of the fragments, in order to form an artificial joint.

It is to be noted that, by way of contradistinction, the intra-capsular fractures of the femur are usually transverse, and the extra-capsular oblique; hence, the more or less movement of the latter during the cure does not prevent coaptation of the osseous surfaces.

M. Guérin, however, deems the apparatus of M. Bonnet, of Lyon, as the most perfect: This consists in a *solid gutter*, which embraces the two posterior thirds of the fractured limb, and the two posterior thirds of the pelvis and abdomen. It is constructed of solid iron wire posteriorly, and which is thinner on the sides, and so supple as to be separated from, or approximated to, the axis of the gutter at pleasure. The gutter is lined with a thick layer of hair, and over this a solid ticking, (*maintenue par un couil solide.*) On the sides of this gutter, above the two trochanters and on a line with the knees, are buckles from which proceed cords, which extend to sheaves and pulleys at the tester of the bed. A large notch is left, on a line with the anus. The patient can raise himself horizontally from his bed at pleasure, by pulling upon the cords. By this apparatus, the body, when moved, is so moved in its totality, and the vertebral column makes no distinct movement on the pelvis, nor the pelvis on the thigh; consequently the fragments are not displaced. To prevent rotation outwards, (always a seri-

ous impediment,) the borders of the gutter are raised on each side of the foot to the height of the extremity of the great toe. The continued extension is made by means of a weight, which passes over a pulley fixed to the apparatus. The lateral movements of the trunk are limited by lateral prolongations, which ascend nearly as high as the arm-pits.

M. Guérin regrets that this admirable contrivance is not yet in use in the hospitals of Paris.

In fractures of the *patella and olecranon*, M. Guérin finds the same objections existing in the apparatus employed, as none of them effect the great object in view, that of opposing successfully the strong retracting power of the extensor muscles upon the upper fragments, from whence arises a fibrous instead of osseous union for want of contact and immobility of the fragments.

To control the action of the triceps in fractures of the olecranon, he proposes three splints of wood, to be adapted to the three portions of the muscle, and the whole to be fixed by the starched bandages or starched pasteboard; our objection to which latter *inamovible* dressings, until after all inflammation and tumefaction have totally subsided, we have too frequently expressed in this work to recur to again. M. Guérin has had as yet no experience in the apparatus he proposes for the olecranon.

In fractures of the *patella*, this surgeon commends (without any personal experience in the matter) the apparatus of M. Malgaigne, which consists of a double erigne, which secures the tendon and ligament of the patella, the two portions of which erigne, approximated by means of two plates of steel, are fixed by a pressure-screw (*vis de pression*.)

M. Guérin, however, would be inclined to use splints to the triceps cruris reaching from the upper part of the thigh to the patella, and over these a dextrine bandage as for the olecranon, the limb at the same time to be kept in extension and the fragments kept in contact by the bandage for transverse wounds. [We refer for a more ingenious contrivance to a box with morticed holes to effect the last-mentioned and most important and only essential object, and which we have noticed in our Vol. I. T.]

As a corroborative evidence of what is now daily becoming more and more established as a physiological axiom, that the *upper portions of the lobes of the brain* may undergo great destruction and diminution by wounds, surgical operations, &c., without causing death, we have to record a remarkable fact related in the *Raccogli-tore Medico* for April, May and June, 1845, (Italian Journal—see *Gaz. Méd.* of Paris, Sept. 27, 1845, t. XIII., No. 39, p. 613, 614,) in which a *fœtus*, in consequence of its suspension on the upper strait of the pelvis, had to be extracted by Levret's perforating forceps, during which, though there was, it is thought, at least *one quarter part of the entire brain* discharged (!) the child was born alive, cried lustily, showed vigorous muscular power, and lived twelve hours! The accoucheur was M. Real.

[It might, *à priori*, be conceived that the vital functions gene-

rally, would be less affected by lesions of the encephalon at this period of the first moment of birth, when respiration is the predominating function that commences and constitutes the first link of extra-uterine life. The brain, it is true, is like the liver, largely and disproportionably developed in intra-uterine life, but *after birth* exercises certainly a less controlling influence over the economy than the respiratory organs and those of the blood and its secretions which now for the first time begin to be called into action. T.]

Among the received opinions of the last twenty years, now called in doubt by that able pathologist, M. Longet, is the one which considered it as established, that the abstraction of the *cerebro-spinal*, or cephalo-rachidian liquid, was the cause of the tottering gait in the muscles of locomotion which animals exhibited (as if intoxicated) on making this experiment. M. Longet has shown (Sitting of the Academy of Sciences of Paris, *Arch. Gén.*, Juillet, 1845, p. 376-77,) that the division of the posterior cervical muscles and supra-spinal ligament, produces the same results; and also that they were *not* produced by abstracting the liquid from the dorsal portion of the spine by opening down into its cavity, without dividing its muscles and ligaments.

The case we have cited in the notes to the text of this volume of a cure of spina-bifida, by freely evacuating this liquid by a large wound, and then by the twisted suture procuring a firm protecting *cicatrix* from the wound, is certainly in favor of the truth of M. Longet's experiments.

Supposed Entire Division of the Spinal Marrow and Perfect Recovery.—A case is related (unprecedented we believe in surgical records) by Dr. E. Hurd, of Middleport, Niagara county, New-York, (*New-York Jour. of Med.*, Sept., 1845, p. 165, &c.,) in which a man falling upon a long sharp chisel in his pocket, caused the instrument to penetrate into the spinous processes and bodies of the dorsal vertebræ, where it was embedded solid and fixed to the depth of five inches transversely and obliquely across the spine, so firmly that immense force was required to extract it; which was effected, however, by the surgeon, some few minutes after the accident, by a blacksmith's pincers, the patient being on the instant of the accident more or less insensible in the parts below the wound, and therefore fortunately unconscious, to a great degree, of the violent efforts of traction required to extricate the implanted instrument. The wound healed rapidly, with little or no suppuration, and the patient after some years recovered almost perfectly the use of his lower limbs, so as to walk and mount on horseback without difficulty.

The clean division made by the chisel through the bone and medulla, though probably not totally through the latter, must account for the extraordinary cure without interruption of the functions of the column; a fact which, from what is now familiarly known of the ready union of the ends of nerves in their section in neuralgic tenotomy, &c., is not perhaps beyond the limits of possibility. [See our notes in the text of this Vol., under *Nerves*. T.]

Mr. R. S. Davis (*Lond. Lancet*, July, 1845, p. 81,) affirms that he has treated several *nævi-materni* with the happiest success in the space of a few days, by merely injecting into them, through several small punctures, and by means of Anel's syringe, a saturated solution of alum, until the tissues are well distended. He trusts the practice, which he says originated with the late Mr. Tyrrell, will come into favor with the profession.

Though *amputation at the femoro-tibial articulation*, in other words, disarticulation of that joint, has generally been proscribed by Mr. Syme and others as more dangerous, and not furnishing as good a stump as amputation of the thigh through its condyles immediately above the articulating surfaces of the knee, [see our notes, this volume,] this disarticulation, however, is still preferred by some, and has been practised in two instances with entire success by M. Murville, Surgeon in Chief of the Military Hospital of Lille, (*Gaz. Méd. de Paris*, November 31, 1845.) In one, an infant aged 20 months, whose leg was crushed by the wheel of a carriage on the middle portion of the limb, sphacelus supervened and extended to about a finger's breadth from the inner tuberosity of the tibia. The gangrene becoming limited, the leg was amputated in June, 1845, at the knee by a circular incision, preserving as much of the skin as possible in front, and of the tissues of the muscles posteriorly, the latter in order to fill up more perfectly the inter-condyloid notch. Union was effected by first intention by means of four sutures and some adhesive straps; and in order to prevent more effectually the admission of air into the supra-patellar synovial cul-de-sac, the lodgment of pus there, and infiltration of liquids into the cellular tissue of the popliteal space, two graduated compresses were applied, the one in front and the other behind the extremity of the stump. On the tenth day all the ligatures, including that on the popliteal artery, had come away, and the wound was perfectly cicatrized. Forty days after the operation a wooden leg was adapted to the stump, which latter was as excellent a one as could be desired. The amputated limb became perfectly developed, and the patient, at the time the case was drawn up, (by M. Ollagnier) could use it with astonishing facility.

In the other case, a man aged 48, the tibio-tarsal articulation was crushed by a block of wood, and from neglect to attend to the patient violent inflammation had ensued, involving the whole leg in gangrene; after reducing which by suitable means, and especially by four deep incisions in a direction with the axis of the limb, each from 5 to 9 inches long, and two of which were in the anterior and two in the posterior tissues, besides dividing the aponeuroses transversely to their fibres, the gangrene was in this manner by the sanguineous depletion and the elimination of the purulent collections, finally localized and limited.

The mortification having extended as in the other case to within a finger's breadth of the anterior spine of the tibia, it was concluded to amputate at the joint, and not to defer it any longer for fear of purulent absorption. The operation was performed 16 days after

the accident by the flap method,—one incision which was circular and in front, and two fingers' breadth below the patella, being extended from the lateral internal to the lateral external part of the knee, while the other incision was made posteriorly so as to procure a thick flap in the tissues in that direction. Ten ligatures were used, including that on the popliteal artery; the wound was united by six sutures and adhesive straps, with graduated compresses as in the other case, one above the patella, the other on the inter-condyloid space. The operation was accomplished in 30 seconds. Sixty-two days after the operation an excellent linear cicatrix was formed, situated transverse to and at the apex of the stump, which latter it divided into two parts, one anterior and rather small, in which was comprised the patella strongly retracted and slightly movable at its inferior portion; the other posterior in which was included the most projecting point of the condyles. On this latter portion fell the pressure of the wooden leg, which he continued to use up to the last date (Oct. 10, 1845) with as much ease as if he had been operated upon at the place of election.

A perfect cure of a case of *spina bifida* in a child aged about nine years, was effected at least *fifteen years since* by Dr. Mott, by means of the entire exsection of the tumor which was near the size of a goose egg, and which had existed from birth over the lower part of the dorsal vertebræ. The integuments and sac had become very much thickened, so as to have even a normal appearance. An elliptical incision was made on each side of the tumor, in order to leave integument enough to be approximated over the deficiency in the vertebræ. The wound was then treated by interrupted sutures in the manner of hare lip. It healed perfectly by the first intention, and the child was completely cured and afterwards enjoyed vigorous health. It will be seen, therefore, that this process lately successfully revived, (see notes in the text of this volume towards the conclusion,) was certainly employed in this country, and with the most happy result, by Dr. Mott, as far back as the year 1830. A case, we perceive by the *Gaz. Médicale*, has very recently been cured in France by excision of the tumor, and then uniting by a sort of quilled suture.

P. S. T.

NEW ELEMENTS
OF
OPERATIVE SURGERY.

SECTION FOURTH.

OPERATIONS WHICH ARE PERFORMED UPON THE ARTERIES.

THE principal operations that surgery employs upon the arteries, are compression, cauterization and crushing, (l'écrasement, breaking up,) torsion and acupuncture, suture and the ligature. Before examining these operations themselves, it is important to recall in a few words the structure, the anatomical peculiarities, and the resources which nature makes use of to cure the diseases of the arterial system.

CHAPTER I.

ANATOMICAL REMARKS.

Every artery is formed of three coats or three concentric cylinders, which are very distinct in the large trunks, but imperceptibly blended and incapable of being any longer separated when we come to the capillaries.

§ I.

The *middle coat*, (tunique moyenne,) called also the muscular coat, or tunica albuginea, is a yellow membrane composed not of longitudinal fibres, but of incomplete fibrous circles which are united together by lamellæ of the same nature; no vessel is seen there whether sanguineous or lymphatic, though certain observers have asserted the contrary. It is a layer which is almost inert, and which is broken like glass if strangulated by a thread; and is torn instead of being stretched when the least degree of force is exerted upon it. On the outside it is united to the external coat by an amorphous (informe) layer only of lamellar material, scarcely

organized; within, the internal membrane adheres to it in the same manner. As it is destitute of sensibility, and of almost all the other properties of living tissues, it is not astonishing that the diseases of which it may be the seat, should for the most part at least be independent of vital phenomena, and that they should seem to be developed under the influence of the laws which belong to inert matter. It is this tunic which distinguishes the arteries from the veins, causes them to remain open when they are divided transversely, gives them their form and colour, renders their diffused and spontaneous inflammation so difficult and so rare, prevents their wounds or incomplete divisions from cicatrizing by agglutination, and enables them to make such successful resistance to the lateral pressure (effort) of the blood. As this coat increases in thickness as the arterial trunk is nearer to the heart or of greater size, or destined to receive a greater degree of impulsion from the blood, so is it also somewhat thicker upon the convexity of the arterial curvatures than on the opposite side. When we come to the branches of the fourth or fifth order, in approaching in fact the last ramifications of the vascular system, we see it becomes thinner by degrees and that it loses itself in the common tissue of the two other coats; from whence it follows that the arteries are so much the more pliant (*souples*) and distensible, (*extensibles*), and so much the less liable to break, all other things being equal, in proportion as they are smaller or more remote from their origin.

§ II.

The *internal coat*, which some have wished to compare to a mucous membrane, and which others assimilate to a serous membrane, is smooth and generally unctuous on its free surface. Externally it adheres to the preceding coat only by thin plates of lamellar tissue; it contains no perceptible fibres or vascular canals; it is in fact only a homogeneous lamellar substance, a kind of varnish in some respects similar to the transparent cornea, or to the substance of the nails or horny tissue in general, and which protects the current of the blood throughout the whole extent of the arterial system. In the small branches and in the capillaries, this coat being no longer separate from the cellular coat by the middle membrane, assumes properties which approximate it much nearer to an actual organization, in permitting its external surface to receive fluids by direct transmission; elsewhere it is thicker and more distinct but extremely fragile; isolated throughout the whole vascular system by the yellow coat, (*i. e.*, the *middle*—see above,) it exists there only as a simple inorganic tissue, like the cartilages, endowed with very little elasticity and very easily ruptured. From these characters it follows that the internal membrane of arteries is still less liable than their middle coat to become affected primitively with diffused spontaneous inflammation, that it cannot become the seat of this morbid phenomenon unless it is transmitted to it by the surrounding tissues; in a word, that it only becomes

altered mechanically, unless it receives by its contiguity to the other coats the diseases with which they may be affected. In that respect I compare the internal coat of arteries to the cuticle, (epiderme,) to serous membranes in general, and to cartilages of incrustation in particular, which do not inflame at first except by their adherent surface or cellulo-vascular lining (doublure.)

§ III.

The *external* or *cellular coat* of the arteries, is the only one which presents all the characters of a true tissue. It is formed of small fibres and lamellæ, crossing each other in various directions and felted, (feutrées,) like all cellular sheaths; very small arterial and venous vessels traverse it in all directions; these vessels known under the name of the *vasa vasorum*, nourish the whole substance of the arteries, yet do not as I have said penetrate either into the middle coat, or much less therefore into the internal coat; so that the cellular coat of the arterial system is the only one where there exists a real circulation, while the others are scarcely nourished or preserved in their natural or vital state but by imbibition or the simple deposition of molecules. This texture gives it great distensibility, and permits it to yield, without being ruptured, to all the forces that are exerted upon it, allows it to become inflamed, to cicatrize, to contract adhesions with what surrounds it, and to impart to the subjacent lamellæ not only its appropriate diseases, but also its organization; from whence it follows that in the capillary system, where it forms almost the entire thickness of the vascular walls, life is there more active, and the diseases which are connected with it infinitely more common.

§ IV.

The arteries are every where covered also with a sheath of a uniform character, but much less solid than their cellular coat; this sheath which is called the *common sheath*, similar to that which exists around all the cords (cordons) and fasciculi of the organization, increases and sustains the pliancy of the preceding coat, unites it to the circumjacent tissues, and principally to the accompanying veins.

§ V.

The arteries receive their *nerves* only from the plexus of the great sympathetic, and like the vessels these nerves are observed only in the cellular coat. Externally, however, they are accompanied (cotoyées) by some nerves (cordons) of the cerebro-spinal system. On this subject it is well to call to mind a law noticed by M. Fouilhoux, (*Thèse* No. 35. Paris, 1826,) namely, that for the arteries of considerable size in the upper half of the trunk, the accompanying nerve is always situated at the outside, that

is to say, not so near to the axis of the part, while in the lower limbs it is generally the contrary. But that is not the case either with the median in the fore-arm, the crural in the iliac fossa, nor with the popliteal, &c. Others have asserted without more foundation, that in the upper half of the body the veins cover the arteries; while in the lower half the arteries cover the veins. The jugular is outside the carotid, and does not cover it. It is the same with the subclavian vein as it enters the axilla. If the law of M. Serres is true for the external iliac and for the femoral vessels, it is not so for the hypogastric and those in the popliteal space (*creux*.) In saying that for the upper half of the body the *venæ comites* (satellites) are in front and outside, and that in the lower half they are behind and within, M. Malgaigne (*Anat. Chir.*, t. I., p. 240) commits a similar error. The axillary vein is on the inside, then behind, but not outside. The popliteal vein is found outside, and not inside. What I have found more exact in this respect is the following arrangement. The *nerve, vein and artery*, as we proceed from the skin towards the bone, the *artery, vein and nerve*, as we go from the bone towards the skin. The fore-arm, arm, shoulder, neck, leg, ham, and the thigh itself, justifying this law, I cannot see what authorizes M. Malgaigne (*Anat. Chir.*, t. I., p. 266) to reject it. It is nevertheless true, that the relations of the nerves and veins with the arteries, cannot be given with precision but under the head of each limb or each organ in particular.

CHAPTER II.

SPONTANEOUS TERMINATIONS OF LESIONS OF THE ARTERIAL SYSTEM.

This chapter, without which it would be difficult to comprehend the operations to be performed upon the arteries, comprises aneurisms, properly so called, and traumatic hæmorrhages.

ARTICLE I.—ANEURISMS.

Every aneurism is a dangerous disease: it is rare, when left to itself, that it does not cause the loss of life to the person who is affected with it. The walls of the sac grow thinner as they dilate, and, by degrees, change, and become perforated, (*se perforent*) or gangrenous; the blood and clots contained in the tumor escape outside; an abundant hæmorrhage is the consequence, and this hæmorrhage ceases only with the extinction of life. It is true, that in certain persons, a long time may elapse before such a termination

takes place ; that patients have managed to live many years, even for eighteen or twenty years, with one or more aneurisins, without being thereby seriously incommoded ; of which M. de Renzi (See Italian translation of this work, p. 67,) and Saviard (*Observ.* 61, p. 272, *Jour. des Sav., Janvier*, 1691. See also, *Observ. de Sennert and Preuss*, 30 years in the *Mem. de Ribes*, 28 years, 50 years, *Gaz. Méd. de Paris*, 1835, p. 161) each give an example.

Authors mention also a great many spontaneous cures of this disease.

M. A. Séverin (*Bonet, Corps de Méd., etc.*, p. 96) has seen gangrene threaten to invade the whole of a femoral aneurism, and yet the patient recover perfectly, after a ligature upon the artery. E. Ford (*Ephémérides*, &c., par Lassus et Pelletan, 1790, t. I.) gives the case of an aneurism in the thigh, which, after having attained a considerable volume, gradually diminished, and ultimately disappeared entirely. Reinig published in 1741, (*Thèse de Haller*, extr. t. III., p. 382 ; in 8vo., p. 115,) the case of a traumatic aneurism of the femoral artery, which got well without an operation, and without gangrene. Guattani, Moïnichen, (*Bonet*, t. IV., p. 56,) Pomarest, (*Ibid.*, t. 4, p. 104,) and Albert, also, each give a case of aneurism terminating in gangrene or suppuration, and spontaneously cured. In the body of a young woman, M. Freer found a tumor as large as a small apple, entirely composed of solid tissues, and which had once communicated with the interior of the aorta. M. Darrach (*Journal des Progrès*, t. III., p. 230) says he has seen the same thing at the arch (crosse) of this vessel. Portal (*Mém. sur plus. mal.*, t. I., p. 303) relates, on the authority of Lower, a case of aneurism of the carotid cured without any remedy. Two cases of spontaneous cure of aneurism in the ham have been carefully described by E. Ford. (*London Med. Journal*, 1788, part 2, p 242.) M. H. Martin (*Revue Méd.* 1835, t. III., p. 408) mentions a patient who got well of a popliteal aneurism in the course of a putrid fever. M. Marjolin also speaks of an aneurism of the femoral artery, which terminated in an immense abscess, and ultimately got well. The observations of this kind, however, are so well known at the present time, that it will be sufficient to refer to them while treating of each artery in particular.

§ I.

To arrive at this fortunate result, nature employs different processes. The whole aneurismal sac (poche) may be attacked with *gangrene* ; then the fluid which it contains is decomposed ; the blood or the lymph coagulating above and below, acquires sometimes sufficient solidity completely to arrest the circulation in this part, also to permit the tumor to open and empty itself without danger, the wound which results from this to become cleansed, the suppuration to be established, and cicatrization to be effected, without the least hemorrhage supervening.

§ II.

Acute *inflammation* may attack the walls of the sac, and the surrounding tissues, be propagated to the arterial trunk itself, give place to a true abscess or gangrene, cause an effusion of coagulable (concrescible) lymph above and below the part of the artery which communicates with the aneurism, and produce there adhesions sufficiently solid to resist the force of the blood, and allow the purulent collection to open and empty itself without exposing to greater dangers than an ordinary abscess. M. Guthrie, (*Diseases of the Arteries*, p. 97,) who speaks of two patients who died in consequence of gangrene attacking the aneurism, mentions also a third, who recovered by means of the same accident, though the tumor occupied the fold of the groin.

§ III.

The tumor supported by muscles, aponeurotic sheaths, and thick lamellæ of cellular tissue, by becoming filled with *concentric layers* of fibrine, acquires sometimes, according to Hunter and E. Home, sufficient solidity and size, to re-act with force, in its upper portion, against the arterial trunk which gave origin to it, to obliterate it if it rests against some solid point d'appui, and to suspend in this manner the circulation through this part of the artery. From that time all the blood contained in the sac coagulates, the most fluid portion of it is re-absorbed; the molecular action by degrees diminishes the more solid portion of its elements, and thus ultimately accomplishes the resolution of the aneurism.

§ IV.

In other cases, and which are much more rare, the different concrete (concrètes) layers which are successively formed upon the interior of the sac, finally succeed in filling it up, in occupying the arterial opening itself, and in acquiring so great a consistence that the blood can no longer displace them; so that they become gradually thicker and thicker, and little by little approach nearer and nearer to the axis of the vessel, until they entirely shut it up, and permanently arrest the circulation in that part.

§ V.

Finally, in other cases, still more rare, these concretions, after having completely filled up the sac, arrange themselves in such manner as to close up neatly the lateral opening of the artery, which preserves its calibre without preventing the resolution of the aneurism from taking effect. This is what took place in the case that M. Freer speaks of. M. A. Cooper (Hodgson, *Mal. des Art. et des Veines*, &c.) has met with an arrangement which was yet much more remarkable. "The femoral artery," says he,

"had been the seat of a true aneurism, whose interior lined with very firm fibrinous layers, preserved in its centre a cylindrical canal, having the same dimensions as the rest of the artery." This arrangement Guattani also appears to have met with; and Roe, (Guthrie, *Op. Cit.*, p. 100,) a naval surgeon, also thinks he has seen an example of it in the iliac artery. M. J. Cloquet (*Thèse de Concours*, 1831, p. 91) has seen the same arrangement in the aorta; but is it certain that there was a true aneurism there? Here is a fact of the same kind, and not less remarkable, taken from the practice of MM. Bouchut and Viricel: it was a case of popliteal aneurism. The femoral artery was compressed; the pulsations in the tumor ceased at the end of six months. The patient died at a later period. A small central canal had permitted the circulation to be carried on through the ancient sac. (Floret, *Thèse No. 14, Paris*, 1828, p. 14.)

§ VI.

So long as aneurism was regarded as being most usually formed by the simultaneous dilatation of all the coats of the artery, the hope was indulged of curing it, and of preserving the calibre of the vessel in its natural state. It was believed, that by a proper course of treatment, the aneurismal sac could be forced to recede upon itself, and by degrees, re-assume the place that it occupied in its natural state, so as to restore to the artery its primitive calibre, and all its attributes in the normal condition. Scarpa, on the contrary, endeavoured to establish as an axiom, that we cannot effect the radical cure of an aneurism, whatever may be its situation, unless the eroded, lacerated, (dilacerée) or wounded artery, has been to a certain extent, above and below the place of its alteration, converted into a solid and ligamentous substance, whether this change has been effected by nature or brought about by the processes of art. Confined to aneurisms, properly so called, this proposition is true, and does not in reality appear to allow of any exceptions. The observations of MM. Darrach, Cloquet and A. Cooper, which have just been cited, and some others that are found in the work of M. Hodgson, do not in any manner refute it; for, in the cases related, the diseased artery had in no respect re-acquired its natural condition.

In respect to *arterial wounds*, the proposition of Scarpa seems, on the contrary, to be invalidated by certain facts. The author himself relates one which is opposed to it. A patient mentioned by Monteggia, died twenty months after having had the brachial artery wounded by the point of a lancet. The aneurism had been cured for a long time, and the artery had preserved its calibre; notwithstanding which, there was seen in the interior of this vessel, a cicatrix, which was supported externally by a blackish-colored, very hard clot, (caillot) corresponding to the ancient wound. Observations more or less analogous, have been related by Saviard, Petit and Foubert. I have in my possession some that are still

more remarkable under this point of view. In a patient, whose artery had been wounded during venesection, and who was brought to La Charité, where the existence of the aneurism was ascertained by a great number of persons, the tumor ultimately disappeared without the circulation in the wounded vessel having ceased for an instant. In a young man, in whom a knife had pierced through one of the veins, and the artery in the bend of the arm, the tumor and all the other characters of varicose aneurism (*l'anéurisme variqueux*) disappeared in the same manner, without the pulsations having ceased to be perceptible a single day, throughout the whole course of the radial and ulnar arteries. It may be that the wound of the artery in these two cases, was closed by a simple solid clot, and was only therefore a temporary cure; but perhaps, also, the general question requires to be examined anew. Nevertheless, it is true that these two cases, cured since three years past, exhibit at present not the least trace of aneurism at the bend of the arm. It is also true, according to the statement of M. South, (*Medico-Chirurgical Review*, April, 1836, p. 550,) that five cases similar to those of mine, and one of which was examined after death, have been seen in the practice of M. Tyrrel at London. We should do wrong however, to count on such a termination, though M. Neil (*Arch Gén. de Méd.*, 1838, t. II., p. 108) says he has seen a wound of the thoracic aorta cicatrized in the dead body of a man who had been wounded a year before; this however occurs too seldom to authorize us to hope for success by this mode. It is only an exception, which cannot destroy the principle established by Scarpa.

ARTICLE II.—TRAUMATIC HEMORRHAGES.

There are no portions of the circulating system whose wounds do not sometimes close up spontaneously.

§ I.—*The Heart.*

The heart itself is an example of this; here are two instances in proof of it. A multitude of observations collected by M. Sanson (*Thèse* No. 159. Paris, 1827) and others, prove, in fact, that wounds penetrating into this organ are not in all cases immediately fatal. In forty examples I have collected, of cases of wounds penetrating into the heart, I found two of them in whom death did not take place until the third day; two where it happened on the fourth; seven where it occurred on the fifth; one on the sixth; two on the seventh; one on the eighth; one on the ninth; one on the eleventh; one on the eighteenth; one on the nineteenth, and one on the twentieth. It is also to be remarked, that in a case noticed by M. Champion, death was caused by a *cardo-pericarditis*. [In the two cases only that Dr. Mott has seen, death occurred immediately. T.]

A patient mentioned by M. Alquié, (De Montègre, *Thèse* No. 6. Paris, 1836, p. 7,) who had a wound penetrating the right auricle, also survived for twenty days. The young Gaspard Hauser, (*Ibid.*,) who after receiving a stab, went more than a league on foot, and who did not die till the third day, had the apex (pointe) of his heart wounded. The clerk of whom M. De Montègre (De Montègre, *Thèse* No. 6. Paris, 1836) speaks, had the heart pierced by a dresser knife, six days before he died.

Other facts show that some of these wounds may recover perfectly. The cicatrices in fact, prove it, as in the case of Senac, and another related in the *Gazette de Santé*; (No. 6, p. 2, 1761;) Chastenet the father, and Chastenet the son, (*Journal de Horn*, c. II., p. 386-387,) have each reported a similar case. De Laserre (*Bibliot. de Planque*, c. XXVII., p. 180) speaks of a living dog whom he had made use of, to demonstrate the thoracic viscera, and who, though he had leaden balls in the heart, pericardium, mediastinum and intercostal muscles, was robust and fat. I opened at the hospital of the Faculty, in the service of Bougon, the dead body of a coal-man, who died in 1825, in consequence of a pneumonia. This man, who had received a thrust from a knife many years before, and who after a series of dangerous symptoms finally recovered from the wound, had a distinctly marked cicatrix in the right ventricle of his heart, and a large hole with thin edges in the corresponding region of the pericardium.

§ II.—*The Aorta.*

If it were advanced that the muscular structure and natural consolidation (entrecaillement) of the fibres of the heart readily account for these results, I would remark that the largest sized arteries have also sometimes exhibited similar effects. A person who had a wound of two lines in the thoracic aorta, did not die till the third day. (*Gaz. de Santé*, 1787, p. 191.) In another, mentioned by Chastenet, (*Jour. de Horn*, t. II., p. 360 et 375,) life was sustained for six days; in a third example, related by the same author, death did not occur until the seventh day. Lerouge, in Saviard, relates that an individual thus wounded survived till the eleventh day. Pelletan (*Clin. Chirurg.*, t. I., p. 92) even speaks of a patient who, having had the aorta pierced by a foil, nevertheless lived for the space of two months. But I am not aware that any one has ever substantiated the radical cure of any wound of the aorta. The patient of M. Neil (of Bamberg,) was cured, but died of pneumonia at the expiration of a year; the cicatrix however, of a quarter of a line, and the small thrombus which were found upon the aorta, were not incontestable evidence that this artery had actually been wounded. We find in Guattani, (Lauth, *Coll. d'aut. lat.*, §c.,) the singular case of a man who had lived several years after having had the aorta wounded, and in whom there existed a varicose aneurism between this artery and the vena cava. M. Syme, (*Gaz. Méd. de Paris*, 1833,

p. 51. *Arch. Gén. de Méd.*, t. XXVIII., p. 403,) has given a similar fact. Animals whose heart or aorta I have pierced with long needles, have perfectly recovered. If from this artery we pass to those of the limbs, facts are abundant to show that nature often possesses the power to obliterate them when they have been wounded, and effectually to arrest the hemorrhage resulting from their wounds.

§ III.

Having collected with another object in view, about fifty examples of this kind, (*Jour. Hebdom. et Universel*, t. I., p. 144 et 488,) I have satisfied myself that the largest arteries, notwithstanding positive evidence of their having been divided by crushing, (*écrasement*,) tearing, (*arrachement*) or amputation of the part, do not always give rise to hemorrhage, or that they often admit of the hemorrhage being effectually arrested; although we have applied to them neither compression nor the ligature. Among these cases there were found thirteen for the arteries of the fingers, hand, or foot, four for those of the fore-arm, seven for those of the arm, eight for the leg, and seventeen for the thigh. More than half the patients were cases of amputation. In the case cited by M. Fern, and that of M. Mussey, it is seen that the arm and entire shoulder had been torn off.

§ IV.

It is then at present an indisputable fact, that the arteries of the limbs, when once opened, either by laceration, (*déchirure*) or by actual division, and left alone, may in reality become obliterated. I had therefore come to the conclusion, in the treatise above referred to, that this result, so common in animals, would often also be observed in man, if, after operations or wounds, prudence permitted us to wait for it. M. Guthrie, who had been struck with the same peculiarity, came to a similar conclusion; but it must not here be forgotten, that we have not yet had it in our power to submit to any law or rule, the spontaneous cessation of arterial hemorrhages, and that it would be dangerous to depend upon it in the human species in arteries of any considerable size.

As to the process (*mécanisme*) it is still enveloped in a great degree of obscurity. The experiments of Jones and Béclard have shown that longitudinal wounds in arteries more easily allow of the suspension of the hemorrhage than transverse wounds; and that in these latter, the bleeding is more difficult to arrest when they are partially divided than when their division is complete. The section of the whole calibre of this vessel augments the chances of its obliteration, either in consequence of the retraction of its two axes, or by means of the species of compression that the other soft parts soon exert upon it. This fact well known to the ancients, inasmuch as Celsus and also Galen, (*De Curand. ration. per*

Venesect. chart. t. X., p. 45.) who could not arrest a hemorrhage at the ankle-bone without completely dividing the artery, and Avicenna and Guy de Chauliac had already noticed it, has been demonstrated anew by a great number of the moderns, so clearly, that in order to arrest certain obstinate hemorrhages, there are many who after the example of M. Larrey, (*Mém. de Chir. Mil.* t. III., p. 29,) recommend making a complete division of the artery at the line where it is wounded. As to knowing whether the artery thus divided, closes in consequence of the contractility of its coats, as Morand, Briot, Taxil, Bonfils, M. Larrey, and M. Guthrie have maintained; or as Pouteau suggests, by means of the compression of the sanguineous concretions which are formed around it, or by the formation of a clot in its interior, or by the elongation and thickening of its cellular sheath, as other moderns have thought; it is a question which I cannot discuss in this place, and the facts and details of which may be found in the memoir which I have already cited, also in the Treatise upon wounds by J. Bell, and in the Articles, *Aneurism*, *Artery*, and *Ligature*, in the second edition of the Dictionary of Medicine.

CHAPTER III.

TREATMENT OF ARTERIAL LESIONS.

The principal object in view with Surgeons at the present time in healing diseases of the arteries, is to effect as promptly and with as little pain as possible, the obliteration, either temporary or permanent, of the injured vessel, or that which carries the arterial blood to the organs whose circulation we wish to control.

To arrive at this end certain operative methods have been devised, independent of internal means, regimen, and certain topical applications.

ARTICLE I.—MEDICAL TREATMENT.

Two kinds of means have been employed under this title : The Depleting treatment, (*la médication débilitante*,) or that of Valsalva, and cold topical applications or astringents.

§ I.—*Method of Valsalva.*

Valsalva and Albertini, (*Comment. sur les Mém. de l'Acad. de Bologne*, t. II.,) while they were yet only students of medicine, resolved to treat the first case of aneurism they met with, by

bleeding and the depleting regimen. This was their manner of proceeding: They performed one or two bleedings upon the patient, who was then made to lie in bed for about forty days, and not to take any more food than was barely necessary to support life, with the intention of adding to his nourishment afterwards, as soon as the debilitating treatment had been carried far enough to render it impossible for him to raise his arm, or to move in bed! Hippocrates had already said, that in order to cure a hemorrhage produced by a rupture of the swollen veins (varices) of the lungs, the best remedy was to perform copious bleedings upon the patient until he was nearly exsanguined, and to reduce him by diet to a state of extreme emaciation. Lancisi, Guattani, Corvisart, Pelletan, Hodgson, Sabatier, Boyer, M. Andréini, (*Arch. Gén. de Méd.*, 2me série, t. VI., p. 575,) and others, obtained by the employment of this treatment, some advantageous results and even cures, if we are to believe the Annals of Hecker, (*Rev. Méd.* 1828, t. IV., p. 103.) It must nevertheless be confessed, that it is difficult to comprehend its efficacy. There can be no doubt, that by bleedings frequently repeated, and by a severe diet, we may reduce the impulsive force of the heart and the pulsations of the tumor; the size of this tumor will in most of the cases diminish; but is it not to be feared that in debilitating the patient we increase the fluidity (fluidité) of his blood, and that instead of favoring the concretion and solidification of the aneurism, and the obliteration of the artery, we may on the contrary render those different phenomena more difficult to be accomplished? When we recollect with what facility the least emotion, or the slightest movement, produce violent pulsations of the heart, and that in thus reducing our patients to extreme debility, (anémie,) we put them in a condition in which it is impossible for them to support the least operation; in fact, that the slightest malady may then prove fatal; when we remark moreover that up to the present time the cures effected by the method of Valsalva, are extremely limited in number, if in fact it can in reality claim any that exclusively belong to it, may we not be allowed to question its importance? Though M. Renzi, (*Italian Transl. of this book*, p. 71,) says, all the patients in the Hospital of Incurables at Naples are submitted to this course, M. Zaviziano has assured me that these patients are not cured of their internal aneurisms.

Nevertheless, the sanguineous depletions and the debilitating regimen ought not to be proscribed in our treatment of aneurisms. When the disease has its seat in the aorta, out of the reach of surgical remedies, it is proper to have recourse to it, and to join with it the preparations of digitalis so much extolled by M. Yatmann, M. Brook, and other English surgeons. Some facts related by Pelletan, (*Clin. Chir.*, t. I., p. 77,) Sabatier, Delpech, M. Roux, &c., lead to the belief that this combined treatment is not entirely destitute of efficacy, and that it should not be neglected, when we have nothing better to make trial of. The retardation (*le ralentissement*) of the circulation, and a perceptible but mode-

rate diminution of the mass of blood, might, it may be conceived, allow of the fluids in the aneurism to become solidified, and the tumor to become completely indurated, especially if the lateral orifice, by which it communicates with the artery, is irregular and very narrow. We may also understand how such a tumor resting against the artery might cause its obliteration, since the compression it exercises, though insufficient in the natural state of the tumor, is then great enough to resist the impulsion of the heart. [Professor Henderson, of Edinburgh, in his course of Clinical Lectures in that city, (*Cormack's London and Edinburgh Monthly Journal of Medicine*, May, 1843, pp. 443 to 457,) while treating with more clearness and good sense than most writers do, on the subject of Auscultation as a means of diagnosing thoracic and sub-sternal aneurism, as of the aorta and *arteria innominata*—and more especially, after laying down many apparently plausible rules for distinguishing the pure and second sound of the heart, or that of the recoil of the blood in the large vessels upon the semilunar valves, from that of the murmur of its regurgitation into the ventricle, or of its passage through the aperture of the aneurismal sac—and also after specifying the danger of a false diagnosis from the impulsion of the heart, communicated, for example, through a hepatized portion of lung, an empyema, (ossific formation and tumors, he could have added,) and that the law, as laid down or discovered by this professor, (as he seems to assert,) that an abnormal interval of time between the diastole of the heart and that of the remote arteries (as the radial, for example,) is a sure diagnosis of regurgitation of blood into the left ventricle, and therefore of incompetency of the aortic valves fully to perform their office, and consequently a proof that an operation for aneurisms of the *arteria innominata*, under such circumstances, must never be attempted—(all of which valuable knowledge, if true, for the surgeon, does not rigidly come within the limits of this work, but rather of pathological surgery, especially in the present imperfect condition of the doctrines of auscultation and percussion,) makes, however, an observation which may properly be inserted within the text of our author, as it has immediate practical reference more particularly, and also furnishes corroborative evidence to the truth of the new principles laid down in the improved mode of treating aneurism, as recently established in a most successful and satisfactory manner by the surgeons of Dublin. (See an article on this subject, *infra*.) Professor Henderson says he has no doubt that even these formidable, if not appalling, sub-sternal and thoracic aneurisms of the great trunks, as well as those elsewhere situated, have been permanently cured by the formation of coagula within them, that have ultimately obliterated their cavity. The extreme measures of Albertini (continues this surgeon) and Valsalva (i. e., excessive depletion by venesection, starvation, &c.) are not now adopted with the view of facilitating this occurrence; and, indeed, it has been well observed that these measures do not seem calculated to effect the object for which they were recom-

mended. Frequent and large blood-lettings and extreme abstinence lessen the amount of the animal solids in the blood, and thereby diminish the probability of fibrinous coagula forming in the sac of an aneurism. (See also Dr. Bellingham, in our note, on Compression for the Cure of Aneurism; and also note on Mr. Luke's case of *tubular aneurism*, infra.) T.]

§ II.—*Refrigerants and Styptics.*

Almost all the ancient authors pretend to have cured aneurisms by the employment of compresses, saturated with liquids or other substances of an astringent nature, or by different kinds of plasters or bags filled with tan-bark, (tan,) or by means of decoctions of bistorte, bark of the oak or willow, the leaves of the walnut, spirits of camphor, vinegar, hot wine, potter's clay, (*Kanelski, Bullet. de Férussac*, t. XVI., p. 450,) sea salt, and ashes, (*Pelletan, Clin. Chir.*, t. I., p. 121.) They supposed, by acting in this manner, they could oblige the artery to recede and retract upon itself. Others made use of cold compositions. T. Bartholin, for example, says he has cured an aneurism in the arm by applications of snow, frequently repeated. But it is to Guérin, of Bordeaux, that we are indebted for having made known the importance of refrigerating applications in such cases. In 1790, there was admitted into the hospital of Saint André a carter having an aneurisinal tumor, which ultimately occupied the entire supra-clavicular region and a part of the neck. A few bleedings, a tisan of eau de Rabel, and the application to the tumor itself of compresses saturated with oxycrate, (oxicrat,) succeeded in effecting the cure of the patient in the space of a few months. In 1795, M. Treyheran treated an enormous aneurism of the femoral artery by the same means and with the same success. M. Guérin, the son, has since reported several similar cases. In 1799, Sabatier cured, in the space of four months, a patient with an aneurism in the ham, by soup and bouillon as his only nourishment, or acidulated tisan, and ice applied to the tumor. Pelletan also had recourse to cold applications, together with the method of Valsalva. A patient whom M. Faucon (*Gaz. Méd. de Paris*, 1837, p. 313) treated by the method of Pelletan, was cured of an aneurism after all other attempts to bring about this result had been abandoned. Since that time, M. Hodgson, M. Larrey, M. H. Martin, (*Rev. Méd.* 1835, t. III., p. 408,) M. Ribes, (*Bullet. de la Faculté*, 7e année, p. 87,) M. Bacqua, (*Ibid.* 6e année, p. 133, 140,) M. Gintrac, (*Ibid.* t. IV., p. 301,) and some others, have related facts which go to the support of the method of Guérin, the efficacy of which, however, is called in question by another surgeon of Bordeaux, M. Moulinié, (*Bullet. Médical de Bordeaux*, 1833, p. 6.) M. Zaviziano, who has not seen a single example of the successful treatment of internal aneurism at Naples by the method of Valsalva, informs me that many aneurisms of the limbs, however, have been cured there by associating topical ap-

plications with this method. Topical applications, then, and refrigerants, whether we employ them alone or combine them with the method of Valsalva, or indirect compression, constitute a means which we may be allowed to have recourse to when the more certain methods that we possess are not applicable, or that patients do not wish to submit to them. Their action also is easily explained. Under the influence of such topical applications, the heat sensibly diminishes in the part; the circulation there becomes less active; the effused blood loses its fluidity, and strongly tends to coagulate; and if the system should be already in a condition to favor such a termination, the result is that the artery closes and becomes obliterated, and a perfect cure is accomplished.

ARTICLE II.—SURGICAL TREATMENT.

We shall now take into consideration the compression, cauterization, suture, torsion, crushing, (*écrasement*), acupuncture, and ligature of arteries.

§ I.—*Compression.*

We have already spoken of compression as a hemostatic means during or after operations, (*vide supra*), and I shall return to it again in speaking of amputations. I shall consequently only treat of it here under the character of a special operation, and in reference to the morbid conditions which require it, or for which it is used. Possessing as it does the power to arrest the course of the vital fluids, compression of the arteries is naturally calculated to produce a marked alteration, whether for good or for evil, in all the vital functions of the system, and in the greater number of diseases. Until the present time, however, it has scarcely been spoken of but as a remedy for hemorrhages or aneurisms. But under whatever point of view it is considered, this method of treating the arteries is divided into two kinds, viz., permanent and temporary compression. Permanent compression cannot be examined except in its connection with wounds of arteries, aneurisms, amputations, and operations in general. As to temporary compression, I have already described the manner in which it is to be made during the progress of operations. It is necessary now to say a word of it in reference to its control over certain diseases.

A.—*Compression in cases of Neuralgia, Congestions, and Inflammations.*

As compression of the arteries, moderates and even arrests the circulation in the organs situated underneath, it seems at first sight to constitute an excellent remedy in congestions, engorgements, and acute inflammations of all kinds. It is, therefore, somewhat surprising that physicians should, for so many ages, have omitted to

make use of it, under this point of view. At the present time the mind appears to take another direction, and compression of the arteries, if we are to believe its partisans, should become the sovereign remedy in convulsions, epilepsy, inflammations, congestions of the brain, cerebral fever, neuralgias, inflammations of the limbs, wounds of the articulations, compound fractures, gout, rheumatism, &c.

Parry (*Medical Society of London*, vol. III.) had already said in 1792, after Parisot and Emet, of whom I shall speak farther on, that temporary compression of the arteries was an excellent means of curing various diseases, particularly those of the head. Autenrieth had had recourse to it in convulsions, and M. Trousseau (*Jour. des Conn. Méd. Chir.*, Octobre, 1837) has published facts which fully confirm the assertions of the German physician. M. Liston (*Edinburg Med. and Surg. Journal*, vol. XVI., p. 73) thought he had experienced good effects from it in maxillary neuralgia. M. Dezeimeris, (*Expérience*, t. I., p. 66,) in giving the history of this operation, says he has seen its efficacy many times demonstrated in the same malady. M. Earle, (*Dezeimeris*, J. Cooke, &c., on *Exper.*, t. I., p. 74,) who says he has used it with advantage in certain cases of epilepsy, and who in that finds himself in accordance with Parry himself, and sustained by a more conclusive observation made by M. Boileau, has been outdone by M. Preston, (*Calcutta Med. and Phys. Transactions*, t. V.—*Gaz. Méd. de Paris*, 1833, p. 76,) since this practitioner went to the extent of tying the carotid artery to cure a patient of epilepsy. Other practitioners, as Livingston and Kellie, (*Dezeimeris*, *Expérience*, t. I., p. 66,) have, like Parry, employed it in rheumatism; while Ludlow made trial of it principally as a remedy against gout. M. Onderdonk (*The American Med. Reg., Exper.*, t. I., p. 67) asserts that he found it useful in extensive wounds of the joints, and in fractures complicated with inflammation. [These are precisely the cases now in which modern *conservative* surgery has proved that a treatment directly the reverse of compression is to be adopted. See note on the cases of M. Prior, &c., *infra*. T.] Parry recommends it also in ophthalmia, and M. Watson states that he has employed it with success in this disease. All the results which I have just related, and some of which had already been published by me in 1830 (*Jour. Hebdom. Univ.*, t. II., p. 59) and 1833, (*Anat. Chir.*, t. I., 2d ed., p. 444,) had nevertheless remained unnoticed in France, until M. Trousseau on the one hand, and M. Malapert (*Acad. des Scienc.*, Novembre, 1837) on the other, under the belief that they had made a new discovery, have again revived among us the treatment of Parry. It is proper, however, to say, that a French physician, M. Bland, (*Bibliot. Méd.*, t. LXII., p. 145,) had already demonstrated, as the observations of M. Linné, (*Bibliot. Méd.* 1818, t. LXII., p. 157,) M. Trousseau, and M. Allier (*Expér.*, t. I., p. 254) have since done, the advantages of compressing the arteries in cerebral fever, or in convulsions. If we add to these facts a case of sciatica, and also a severe case of complicated frac-

ture, cured by a ligature upon the femoral artery, a case of paralysis treated by a ligature upon the carotid, and the cases of M. Sestier and M. Rayer, as related by M. Dezeimeris, (*Expér.*, t. I., p. 66,) we shall have a sufficient amount of proofs to warrant the recommendation of compression of the arteries in certain cases of disease.

The idea of this treatment also goes much farther back than M. Dezeimeris supposes.

The placing of a ligature on the carotid had in fact been recommended for diseases of the head, by Robert Emet, (*Essais de Médecine*, p. 191–194,) who applied it upon a dog without any inconvenience, and describes how it should be performed on man. Parisot, (*Réflexions sur une pratique proposé pour le traitement des maladies internes, occasionnées par plethore. Journal Economique, Janvier, 1756*, p. 140,) who recommends it for plethora, tied the carotid in three dogs without creating any disturbance in their functions. We find also in Bressy (*Recherches sur les Vapeurs, &c.*) a suggestion to tie the carotid for nervous affections, (*les nerveuses.*)

I do not, however, mean to be understood by this, to say that upon the authority of the observations of MM. Swan, Preston, Gerdy and others, it is my intention to advise the ligature upon the large arteries as a remedy either for inflammations, neuralgias, or cerebral congestions; but inasmuch as we may have it in our power, by temporarily or momentarily compressing those arteries which supply inflamed or congested parts, to moderate both the pain and the other symptoms of inflammation or congestion, I deem it proper to point out to surgeons the rules to be followed in this operation.

To fulfil the indication in question, the operator should act so as to compress as few parts as possible along with the artery, and exert a sufficient degree of pressure to moderate or even to arrest the course of the blood, without making it with such force as to contuse (*contondre*) the intermediate tissues, or to rupture the internal or middle coats of the artery. It is easy to perceive also that this compression, which may, moreover, be prolonged to a greater or less length of time, and maintained for some minutes only, or for the space of twenty-four hours, according as the case requires, is not to be made with violence (*brusquement*;) also that it may be advantageous to diminish it, and even to suspend it from time to time, or to renew it or moderate it (*la relacher*) again before removing it altogether. To do it well, we should in general discard circular bands; the fingers or the thumb, or a seal protected by a pelote of lint, answer better than any other kind of instrument. The tourniquet and other kinds of compressors, all are attended with the inconvenience of selecting for their point d'appui certain parts that are sound, and making therefore unnecessary pressure upon these parts. As it is important, if we do not wish to interrupt the return of blood, that we should make as little pressure as possible upon the veins accompanying the artery, neither instruments with large pelotes, nor any other machines, should

ever be employed, unless the fingers and the thumb appear absolutely insufficient.

There are a great number of arteries to which this mode of compression is applicable. Those of the limbs, neck, iliac fossæ, and even the aorta, readily admit of its application. As the compression should be regulated according to certain uniform rules, whether it be as a remedy for some disease, or to arrest hemorrhage, or to suspend the course of the blood during an operation, I shall now briefly describe how we ought to proceed in applying it to the vessels I have enumerated.

I.—*Arteries of the Head.*

a. If it should be required to make temporary compression upon the *supra-orbital artery*, we would be enabled to effect this without any difficulty, by placing the finger at the distance of about an inch outside the root of the nose, immediately above or under the supra-orbital notch, taking care at the same time to push back the eyebrows towards the forehead. But as the compression of the artery involves also that of the frontal nerve, it would probably be of little use in this region.

b. The Temporal Artery. The most convenient place for compressing the temporal artery is at the distance of about three lines in front of the cartilage of the external ear, and a little above the zygomatic arch. Being in that place not yet bifurcated, and also separated from the bones by only a thin layer of fibro-muscular tissue, it would easily allow of being flattened by the finger, or any kind of pelote.

c. The Occipital Artery could not be conveniently reached except by placing a pelote or some mechanical compressor, properly made between the mastoid process and the upper extremity of the complexus muscle; also it would be necessary that the compressing power should have a tendency downwards between the muscle mentioned and the sterno-mastoid, while pressing at the same time against the occipital ridge (*crête*.)

d. In the face we could not compress the *arteries of the lips*, but by seizing each lip near the commissures between the fingers and the thumb, and directing the pressure from below upwards for the upper lip, and from above downwards for the lower lip. Compression upon one side only, as it would not prevent the blood from returning by the other, would be manifestly of no avail.

e. We might compress the *facial or external maxillary artery*, in the most effectual manner possible, by placing the finger or projecting part of the mechanical instrument, upon the notch which is felt at about an inch in front of the angle of the jaw, or upon the outer surface of this bone, between the anterior border of the masseter muscle and the posterior border of the depressor *anguli oris* muscle.

II.—Arteries of the Neck.

The carotid and vertebral are the only arteries that can be compressed in the neck. The compression of the *thyroid, lingual, and inferior pharyngeal* would be too difficult or too imperfect to be worth the trial.

a. I should add that the entrance of the *vertebral* arteries into the canal of the transverse processes, is too variable to admit of positive rules upon this subject. Nevertheless, if we are guided by the tubercle of the sixth cervical vertebra, designated by M. Chassaignac (*Arch. Gén. de Méd.*, 2e série, t. IV., p. 458) under the name of the *carotid tubercle*, we may perhaps in a considerable number of cases succeed in effecting a sufficient degree of pressure upon them. The patient being for this purpose laid upon his back with his head a little inclined forward, but well supported, the surgeon should cautiously insinuate his thumb or one of his fingers between the trachea and the inferior extremity of the sterno-mastoid muscle, until he has felt the tubercle in question. Then pressing transversely upon the surface (plan) a little under this tubercle to the extent of about an inch, he would almost inevitably flatten the vertebral artery.

b. Carotids. The mode of applying compression to the carotids is the one which has principally occupied the attention of practitioners. Parry, M. Bland, and M. Trousseau, more especially have attempted to demonstrate its advantages. Before deciding upon it, however, it is well to recollect that we run some risk; and as I have already said if it should be carried to excess, we may rupture the coats of the artery. If the jugular vein were compressed at the same time, we may conceive what would be the result of this upon the brain. Nor could the pneumo-gastric or great sympathetic nerve be long compressed without incurring some danger. One of the patients of M. Sestier, and one of whom M. Dezeimeris (*Expér.*, t. I., p. 70) speaks, were thrown into such a state of alarm by it, that they could not afterwards bear to hear it mentioned. It would be necessary, therefore, if we should make up our minds to attempt it, that we should endeavor to press upon the artery in such manner as not to injure the other organs. For that purpose we should select the omo-hyoid space, that is, we should place the finger between the sterno-mastoid muscle and the thyroid cartilage. The artery is not only situated at less depth in this region than lower down, but is also here surrounded with a less considerable number of veins and nerves than higher up. The surgeon, taking care when he feels the pulsation of the carotid to push it a little towards the median line, might easily succeed in compressing the artery alone against the bodies of the cervical vertebræ; while if he made the pressure perpendicularly and inclined his finger or seal a little outwardly, both the vein and the nerves might be en-

dangered. There also as in other cases, should it be necessary to continue the pressure for a long time, we should make use of both thumbs or two fingers of each hand, alternately applied in such manner as to relieve each other.

III.—*Arteries of the Thoracic Extremitly.*

a. In the *fingers* we may, as Parry has done, easily compress the collateral arteries with the view of moderating the pain of whitlow (panaris) or the acute suffering (acuite) from certain kinds of inflammation, should any one have the patience to keep the forefinger and thumb applied over each other for a day or two at a time. We could also effect the same object by maintaining a small graduated compress at the junction of the palmar surface with each border of the diseased finger, and fixing it in this position by a few circular turns of bandage.

b. The *radial artery* could be compressed with great ease either by means of the finger, a pelote, or a mechanical compressor, on the lower fourth of the anterior surface of the radius, at every point in fact where it is sought for as the pulse; but as it communicates extensively with the ulnar artery in the palm of the hand, it would be requisite that the *ulnar artery* also should be compressed at the same time. We should be enabled to do this by placing the thumb crossways upon the forepart of the ulna, at the distance of an inch above the wrist; while the two first fingers of the same hand should take a point d'appui behind. It is to be understood, however, that when we do not wish to use the fingers, the pelote of the compressor (compresseur) or of the bandage or seal should bear on the same point. In the remaining part of the continuity of the fore-arm, the compression of these arteries would neither be easy nor secure.

c. Nor in the *bend of the arm* can we make compression with sufficient effect to rely upon it, which is the less to be regretted, inasmuch as we obtain the same result on the arm itself.

d. The *brachial (humcræle) artery*, if necessary, could be compressed any where on the whole length of the arm, by following the track of a line which would reach from the middle of the hollow of the axilla to the middle of the bend at the elbow. The most convenient point, however, is to be found above the upper insertion of the brachialis internus, and better yet under the surgical neck of the humerus between the two borders of the axilla. At this point, in fact, confined by the coraco-brachialis muscle in front, and by the teres major or the latissimus dorsi behind, it is not separated from the bone by any layer (plan) of soft parts, and neither the nerves nor the veins form a complete sheath to it. This point being selected, we may moreover adopt several modes. The thumb passed into the hollow of the axilla, generally suffices, if we take care to select a point d'appui on the outer surface of the arm for the other fingers, and to press directly against the humerus between the tendons above mentioned. We succeed still better, by grasping the upper part of the arm with the two hands, in such

manner that the fingers may all press against the humerus in the hollow of the axilla, while the thumbs serve as a point d'appui on the outer side of the shoulder.

In the supposition that the fingers alone might be insufficient, we should place either a roller bandage or any description of pelote possessing the requisite solidity upon the same point, in the hollow of the axilla, after which the pressure should be made upon this solid body, either with the fingers, or by means of a bandage or a garrot. There is no necessity of adding that the different instruments that have been contrived for the compression of the arteries, are applicable also to the arm and to the point of the axilla which I have just designated, as well as to the other portions of the limbs.

e. The axillary artery. None of the indications above mentioned can make it advisable to compress the axillary in preference to the brachial artery. If it were deemed desirable to diminish the afflux of blood to the shoulder as well as to the rest of the arm, it would be the subclavian artery to which we must direct our attention. We might also by making the pressure a little higher in the hollow of the axilla, compress the axillary artery against the head of the humerus near the clavicle. But this compression being impracticable except where there is no tumor in the upper part of the arm, is not applicable to aneurisms. It has been proposed in that case also to make pressure upon the axillary artery through the whole anterior wall of this region, and in this manner to flatten it as it passes upon the second rib. The finger or the thumb pressed with a certain degree of force from without inward, and from before backward, upon the pectoralis major muscle, immediately under the clavicle and upon the interstice which separates the head of the humerus from the thorax, generally enables us by this means to suspend the arterial circulation throughout the whole extent of the limb.

If it were required only to obstruct in a slight degree the course of the blood, we could effect this by carrying the arm behind the trunk, in such manner as to draw the shoulder forcibly downwards. Only it is to be remarked that this movement, involving also the compression of the nerves and vein, is apt to occasion shortly after a considerable degree of numbness in the hand. If it were necessary to continue the compression a long time, or entirely to suspend the circulation, we should find advantage in making use of the tourniquet of Dahl, or some of the other compressors invented since. The pelote of these instruments being applied upon the point where I have advised the thumb to be placed, enables us by means of the elastic arc which supports it, to select a point d'appui between the shoulders or under the axilla of the opposite side. It is however very seldom that we are obliged to have recourse to this kind of compression. There are only certain amputations of the arm, and some unusual operations that would call for its employment.

f. The Subclavian Artery. The compression of the subclavian arteries is precisely that which is now substituted for the compres-

sion of the axillary artery, in those cases in which the compressor of Dahl was formerly employed. It is upon the first rib, between the two scaleni muscles, that this artery may be most easily flattened. Resting as it here does, naked upon the bone, with no intervening muscle between it and the skin, and bridled as it were by the fibro-muscular attachment of the two scaleni, it admits of the application of all the different kinds of compression. The most simple, and at the same time the most effectual process consists in pressing with the thumb or two first fingers of the hand in the supra-clavicular depression. Pressing thus from above downwards, and from without inwards, we soon perceive either the pulsations of the artery, or the tubercle of the first rib which borders its track below. Nothing more is then required than to press with a little more force inwardly and backwards, in order to be sure of acting directly upon it. In this manner the vein remains intact in front while all the nervous branches of the brachial plexus are given off above. As the thumb and fingers, however, would soon become fatigued, it is advisable when we wish to continue the pressure upon the subclavian beyond the period of some minutes, to effect this object by means of a seal furnished with a pelote, or with some compressor similar to the tourniquet of Dahl, which we should take care to apply with accuracy upon the region which I have designated.

IV.—*The Artery of the Lower Limb.*

The lower aortic system may also be compressed upon many points of its course.

a. The *Dorsalis Pedis Artery*, (artère pedieuse.) In the toes the collateral arteries are so small and short that it would be difficult and is scarcely ever necessary to undertake their compression. The *plantar arteries*, being deeply concealed in the soft parts, are also placed beyond the reach of the modes of compression which I have now under consideration. The dorsalis pedis artery, therefore, is the only one that can, under this point of view, claim our attention. This artery is to be sought for between the instep and the commencement of the first inter-osseous space of the metatarsus; that is to say, on the dorsal surface of the scaphoid bone, or of the two first cuneiform bones. By placing the two thumbs transversely upon that space, and one over the other, while the fingers take a point d'appui on the plantar surface of the foot, we compress the artery with certainty and in such manner as not to be over-fatigued. The pelote of any kind of compression applied to that region, might easily be substituted for the thumbs, if the operation was to continue for a considerable length of time.

The nerves, veins, and other tissues in the neighborhood of this artery, are of too little importance to be any obstacle to its compression. But as the blood returns directly to the dorsalis pedis through the plantar artery, we cannot see how this compression can, in reality, be of any great assistance.

b. *Arteries of the Leg.* Buried, as it were, in the depth of the muscles, the arteries of the leg do not readily admit of compression between the knee and the lower part of the calf. It is only, therefore, in the vicinity of the tibio-tarsal articulation, that we are enabled to reach them, and the anterior and posterior tibial moreover are the only ones that the surgeon should look to in such cases.

The *anterior tibial* artery, where it courses upon the outer surface of the tibia, might be perfectly flattened, if in selecting a point d'appui for the thumb above and behind the internal malleolus, between the tendo Achillis and the bones, we should compress it from without inward, and from before backwards, with the fingers placed crosswise. If we were to apply a tourniquet, garrot, &c., to the same point we would effect the same result.

To compress the *posterior* tibial artery, we must place the fingers of one hand, or of the two hands, crossing each other, in the groove which separates the tibia from the os calcis, and by this means press from behind forwards, or from within outwards, against the posterior border of the internal malleolus, while the fingers take a point d'appui on the outer part of the instep. It is evident that we could obtain the same result by placing the fingers in front and the thumbs behind the malleolus, in the same way as we could by applying the projecting part of any compressor whatever upon this last point.

Were it absolutely requisite to do so, the compression of the posterior tibial, regulated upon the same principles, might also be practicable nearly as high as the upper part (racine) of the calf; but then it would be almost impossible to flatten the vessel perfectly.

c. *The Popliteal Artery.* The artery of the ham being situated at considerable depth, is utterly incapable of being flattened by indirect (mediate) compression. As it would also be impossible to reach it without compressing at the same time both the nerves and the accompanying vein, the operation in this part would be attended with more disadvantage than utility. It would not be advisable, therefore, to think of attempting it except as a temporary means of relief in certain hemorrhages of the leg. In this case it would be necessary to place the compressing force in the hollow of the ham, above the line of the articulation, a little nearer to the internal than the external border of that region, and to select a point d'appui above the patella, upon the front part of the thigh; the tourniquet or the mechanical compressors would in such cases be manifestly preferable to the fingers.

d. *Arteries of the Thigh.* The femoral artery may be compressed near its two extremities, that is, at the fold of the groin, and at its entrance into the fibrous plane (plan) of the adductor muscles.

1. Formerly, during amputations of the leg, the femoral artery was often compressed *at the lower third of the thigh*. It is true that in placing the two thumbs from within outwards, so as to fall between the vastus internus and the adductor muscles, we soon flatten it against the inner side of the femur, if the fingers take a proper

point d'appui upon the outside of the limb. But it is rare that the hands suffice for this compression, and we accomplish it best by means of the tourniquet, or ordinary compressors. We should not, however, if we wish to make use of the fingers, attempt compression at this point, unless some disease or some abnormal condition should prevent our effecting it in the groin; for we can effect the compression of the femoral artery with the tourniquet with much greater certainty and ease in this region than in the upper part of the thigh.

2. To compress the femoral artery at the *fold of the groin*, we rarely employ any other means than the fingers.

The best mode consists in *fixing the thumb* upon the outer part of the thigh, a little below the great trochanter, and the four fingers on the fore part of the gracilis and adductor muscles, directing them outwardly and backwards, and placing over them the fingers of the other hand to serve as a support. The artery is so perfectly confined by the adductor muscles behind, the triceps in front, and the femur outside, that it is impossible for it to escape or slip in the slightest degree. The thumbs substituted in the place of the fingers, or vice versa, would, it is true, produce the same effect, but would cause more fatigue, and be less certain. It would be the same with a padded seal, or any pelote whatever.

3. Most usually we compress the femoral artery against the *body of the pubis*; this in fact, is one of the most convenient places to do it. There we find the artery at an equal distance from the anterior superior spinous process of the ilium and the symphysis pubis. By placing, then, the fingers, the thumb, or the pelote of a seal on this point, so as to press from before backwards, and slightly from below upwards, as if we wished to push back or depress the middle of Poupert's ligament, we are almost sure to succeed. It is requisite, moreover, that we should not apply the compressive means in such cases until after having distinctly felt the pulsations of the artery with the fingers. The most sure and least fatiguing mode, however, of compressing this artery, as well as all the others, consists in placing the pulp, either of the fingers or the thumb, across the course of the vessel, and in such manner that the fingers of the other hand, pressed against the first, may thus serve to add to their force, and take their place when they are tired.

If it is the right side, for example, the surgeon, turned towards the feet of the patient, places his left thumb transversely upon the place I have designated, and immediately puts the thumb or fingers of the right hand upon the nail of the first, so that the thumb acts with its own individual force while it is not fatigued, and acts the part of a pelote under the fingers of the other hand when it has need of repose, and so on in succession as long as the compression is to be continued.

To make permanent compression, and to avoid as much as possible any interference with the course of the venous blood, it would be necessary to make use of pelote compressors that have more projection than width, and which should be directed a little

outwardly, and applied so as to take their point d'appui upon the posterior surface of the pelvis.

V.—*Arteries of the Abdomen.*

The enormous volume of the arteries in the lower belly (bas-ventre) would render their compression, if it were possible, a matter of great importance; but there are none except the aorta and the iliac arteries that are accessible in this cavity.

a. To compress the *iliac artery* it is requisite, after relaxing the parietes of the abdomen, that we should exert with the fingers, thumbs, or a pelote, a pressure sufficiently strong to fall upon the contour of the upper strait (détroit supérieur) of the vessel, or between this and the inner border of the psoas muscle, upon the track of a line which would reach from the side of the sacro-vertebral angle to the middle of the crural arch. By this compression we may temporarily suspend, or prevent where they have not already taken place, hemorrhages from the thigh. We might also, in the same way, by pressing upon the common iliac, arrest hemorrhages from the branches of the hypogastric artery. It is evident, however, that compression upon the iliac fossæ cannot be indicated but for certain disarticulations of the thigh, and for lesions at the commencement of the femoral artery, or at the lower part of the iliac artery itself.

b. *The Aorta.* Since surgery has presumed to penetrate even into the abdomen to reach aneurisms, we have felt the necessity of some means whereby we might make pressure through the abdominal walls on the aorta itself. Treating of the relations of this artery, I had already said in 1825, (*Anatomie des Régions*, 1e edit., t. II., p. 126,) "Cases might occur in which the aorta would have nothing intervening between it and the umbilical wall except the peritonæum and omentum; so that in wounds of this great arterial trunk it would be possible, in fact, after having relaxed the muscles by the flexion of the trunk forwards, temporarily to suspend the hemorrhage by pressing on the left side of the spine."

From that epoch the compression of the aorta has become the subject of particular researches, and of applications altogether new. I employed it, in the year 1831, upon an occasion in which I was made fully sensible of all its advantages, in a case of wound of the external iliac artery. It is easy to conceive what assistance might be derived from it if we were applying a ligature to the common, or to the external or internal iliac, and in all cases of wounds of those very large trunks. The compression of the aorta however, has principally attracted the attention of practitioners, as a means of suppressing external hemorrhages, and especially those that occur after parturition.

Since the period at which M. Trehan (*Bullet. de Férussac*, t. XVI., p. 452) and M. A. Baneloque (*Jour. d's Conn. Méd. Chir.*, t. I., 1834) contended for its discovery, in 1826 and 1828, it has been ascertained that Saxtorph, Plouquet and Schweighæuser,

had already extolled it under various forms, and that Boër, Madame Lachapelle, and Dugés had also spoken of it. There are also a multitude of practitioners, as for example, MM. Ulsamer, Eichelberg, Siebold, Blount, Lovenhart, Brossart, Latour, and Martins, whose observations I have elsewhere referred to, (*Tocologie, ou, Traité de l'Art des Accouchem.*, 2d edit., t. II., p. 545,) who assert that they have employed it with advantage in cases of excessive flooding from the uterus. I will add, that I have recommended it, or performed it, four times with success, under similar circumstances, since 1834. This compression, suspending the whole circulation in the uterus, as well as in the lower extremities, necessarily, as we may perceive, puts a period to the dangers which the woman is then exposed to. Had it no other value than to give time to act, and to enable the surgeon to promote by suitable means the retraction of the uterus, it would be a most important resource; but from what I have seen, and it is in accordance with the observations of M. Baudeloque, I feel authorized in giving it as my opinion, that if it should be continued for a quarter or even half an hour at a time, and alternately suspended and resumed, it will, in a certain number of cases, be sufficient to put an effectual stop to the hemorrhage.

Three conditions may be met with where it may be considered necessary to make compression upon the aorta.

1. In pregnant women. If the pregnancy has not advanced beyond three months, the state of the womb requires no change to be made in the manipulation of the process. At a later period, and especially after the fifth month, it would become necessary in the first place, to compress the uterus, and this is the aspect under which the first authors, whom I have mentioned, seem to have considered this subject. By pushing upon the womb from below upwards, and from before backwards, with the hands or with a bandage, taking care to incline this organ gently to the left, we would then succeed without difficulty in compressing the aorta. It is probable that the compression of the belly, of which so many writers have spoken, and which has been employed in hemorrhages during pregnancy or parturition, owed its success to this principle.

2. In a woman who has just been delivered, the walls of the abdomen are ordinarily so pliant and flabby, that it becomes exceedingly easy to press them into contact with the vertebral column. The surgeon, after elevating the head and thighs of the patient, by means of pillows, presses the abdomen opposite to the umbilicus, or a little below it. Taking care to push aside (*écarter*) all the neighboring organs by certain undulating (*ondulatoires*) movements, he quickly comes to the spine, where he soon perceives the pulsations of the aorta.

To flatten this artery he has then nothing more to do than to place one of his thumbs crosswise upon it, and to support that thumb by the other, in the same manner, as I have said in speaking of the femoral artery. We may make use of the fingers as well as the

thumb, or of the pelote or the seal properly arranged; but the thumbs are evidently better. By pressing also a little more to the left than to the right, we should avoid the vena cava sufficiently, so as not to interrupt any other than the arterial circulation.

3. In a man, or in women who are not pregnant, the operation is performed in the same manner, but with more difficulty, because of the little pliancy, and also the thickness of the walls of the belly; also, it would require greater precautions in the relaxation of the muscular system, and in the exact application of the compressive forces.

B.—*Compression of the Arteries in the Case of Wounds.*

When an artery has been wounded, and a hemorrhage results from it, compression is the first thought that presents itself, not only to the mind of the surgeon, but also to that of the bystanders. Whether the blood escapes outwardly, as in traumatic hemorrhages, properly so called, or that it is effused and infiltrated into the tissues, as in diffused aneurism, compression nevertheless may be employed in various ways to remedy the difficulty. The practitioner, in such cases, is to look also to two indications: first, either he has no other object in view than to arrest the hemorrhage temporarily, while permanent means are being prepared; or, secondly, he attempts at once a definitive cure by compressing either on the point wounded, or on some other region of the bleeding artery.

I. *Temporary (Provisoire) Compression.*

In cases of arterial wounds, temporary compression is always indicated. We perform it either on the wound itself, or outside of it.

a. To compress *outside the wound*, we must conform ourselves in every respect to the rules laid down in the preceding chapter. This kind of compression will not in general answer in certain regions of the body. On the carotids, for example, it sometimes allows the blood to return by the upper end of the vessel, whereby the hemorrhage is renewed. If we should compress but one of the arteries of the fore-arm, in a wound of the hand or wrist, the other artery in the same region might in like manner keep up the hemorrhage. It is important therefore to compress at the same time the radial and ulnar artery, if we have it not in our power to make the compression both below and above the wound. What I say of the fore-arm must be equally understood of the foot and leg. There are cases also in which, in consequence of some anomaly in the arm or thigh, the same difficulty is experienced in attempting compression upon the root of the vessel only. To effect this compression there are also required certain anatomical conditions which are not always present. The wounds of the subclavian and of the lower third of the carotid, render it manifestly inapplicable.

[See note 30, Mott, *infra*.] When the size or rigidity of the belly is an impediment to the compression of the aorta, we should be in a similar embarrassment for wounds of the iliac arteries and those of the upper part of the femoral.

b. From this we may perceive, that compression *on the wound* itself ought to be in more general use, and that it would be sometimes more efficacious than upon a sound portion of the track of the artery. In this mode compression may be made by means of the thumb, fingers, bandages, &c. The fingers or the thumb should be preferred as often as they can be applied to the bottom of the wound. If there should be too much inequality in the division of the tissues, and too many difficulties encountered in searching for the wound of the vessel, we should succeed better by tamponing (le tamponnement, i. e., plugs, or tampons or tents, *vid. vol. I. T.*) or by small balls of lint, pieces of agaric or graduated compresses, than with the fingers. In case this wound was very oblique, and the situation of the artery not very deep, it might be advisable to seize it in a flap of the soft parts, between the thumb and forefinger, or between the two first fingers. There is no necessity of adding that this kind of compression is attended with the serious inconvenience of irritating the wound, and of preventing the surgeon from being enabled to examine its interior. It is consequently only admissible in the event of the failure of the other method, or while we are looking for a suitable point upon the root of the artery.

II.—*Curative Compression.*

II. If we should desire also to put a definitive termination to the hemorrhage by means of compression, we may recur to either one of the two preceding methods. The ancient surgeons having but very vague ideas upon the circulation of the blood, and ignorant of all the advantages that were to be derived from the strangulation of the vessels, had, for the most part, no other remedy for arterial hemorrhages than compression, caustics, or astringents, which they applied directly to the wound itself; but since the ligature has become known, and that surgeons have demonstrated the impossibility of arresting certain traumatic hemorrhages without obliterating the artery that supports them, compression on the wounded point is rarely any longer employed. Nevertheless there are some surgeons who still recommend it in preference to the ligature, and who do not accept the aid of this last until they have ascertained the insufficiency of compression. Mr. Guthrie, (*Malad. des Artères*, p. 320,) for example, recommends that before we come to the ligature, we should always make trial of compression, unless the wound is manifestly upon the principal arterial trunk of the limb. There are also an infinite number of facts to prove that we may by this means effectually control hemorrhages from arteries of very considerable calibre, (*d'assez grosses artères*.)

A.—Direct Compression.

By means of direct compression and astringents, Jacques Demarque (*Traité des Bandages*, p. 504) cured a wound of the brachial artery in four patients. A similar case has been published by Chappe, (*Jour. Gén. de Méd.*, t. XXV., p. 26.) Caestric (*Gaz. Salulaire*, 1767, No. 46, p. 3) was not less fortunate in compressing by means of agaric, and by bandages and the hand, a wounded carotid. Special instruments had obtained two similarly fortunate results for the father of Muys. Formi (*Bonet, Corps de Méd.*, t. IV., p. 190) cites a hemorrhage of the fore-arm, which he radically cured by plugging (tamponnement) and compression. In a case of wound of the fore-arm, the ligature upon the radial artery not having arrested the hemorrhage, compression was had recourse to, which put a termination to the difficulties, (*Dudaujon, Thèse*, 1803, p. 20.) Bourienne, who blames the ligature and too strong a compression, says he has cured, by moderate compression, a hemorrhage from the inter-osseous artery of the fore-arm. A hemorrhage from the leg, caused by fracture, was thus arrested by Colomb, (*Obs. Méd. Chir.*, p. 403.) I have several times, and once also in 1838, at the hospital of La Charité, effectually arrested, by direct compression, a hemorrhage from a wound in the palmar arch. M. Champion has not been less fortunate in compressing a primitive false aneurism, and it is not to be doubted that a great number of wounds of the brachial artery were formerly cured by the same means. Among the curious examples of them that science possesses, I cannot avoid citing the following: Sent for to a lady of eighty years of age, and who had been bled twenty days before, Myngelouseau found a hemorrhage which had resisted astringents and bandages. It was arranged that students in surgery should hold their fingers upon the opening of the artery night and day for twenty days, by which means a cure was obtained.

We should not, however, rely upon the efficiency of this means but in a very small number of cases. On the dorsum of the foot, behind the internal malleolus, above the instep, at the palm of the hand, a little above the wrist, and sometimes at the bend of the elbow, it may suffice; everywhere else direct compression would expose to too many dangers, and present too slight a prospect of success, to authorize its general use. It would not, in fact, be allowable, under the circumstances I have mentioned, until after we had assured ourselves of the difficulty or impossibility of seizing hold of, twisting or tying the injured artery at the bottom of the wound.

As to the manipulation of this mode of compression, it is the same as for indirect compression, or that which I shall point out in the next article, in speaking of aneurisms.

B.—Indirect Compression.

Applied to wounds, compressive means cannot be maintained

there a long time without causing acute pains, and occasionally endangering very serious accidents. When we wish to effect, by this means, the obliteration of the diseased vessel, we should give the preference to making the compression at some distance above, or, if the condition of the arteries required it, below the wound. Numerous examples of success obtained by this method have been published at every epoch of science. It is for this kind of compression that Verduc (*Pathol. Chir.*, chap. II., art. 1er, p. 147) contrived his collar, (collier,) and that M. Chiari (*Pl. Portal, Clin. Chir.*, t. I., p. 154) boasted of his. A compressing bandage, extended from the wrist to the shoulder, enabled Faivre (*Ancien Jour. de Méd.*, t. LXXIII., p. 376) to cure a wound of the radial artery without ligature. M. Wytterhoeven (*Rev. Méd.*, 1835, t. I., p. 231) speaks of a wound of the brachial artery, followed by a severe hemorrhage, which was arrested by making circular compression above the wound for thirty-six hours only. I have seen a case nearly similar to this in La Charité, in 1837. A young workman, while breaking a square of glass, had made a large opening into the ulnar artery, in the lower third of the fore-arm. To arrest the hemorrhage, his comrades bound the arm up tight with a pocket handkerchief, twisted in the form of a cord. Having on the following day removed this species of bandage, with the intention of tying the artery, I saw no hemorrhage re-appear, and the cure took place without any necessity of applying a ligature. Nevertheless, the artery had been completely divided, as well as the nerves, tendons, and muscles in its neighborhood. Consequently, the temporary compression which we are sometimes compelled at first to make above the wound, upon the track of the injured artery, might in certain cases be converted, with some chances of success, into a curative means of compression. Nevertheless, as it is impossible to effect it without interfering with the venous circulation, the distribution of the nervous fluid, (l'influx nerveux,) and all the other functions of the part; and as it is generally painful, and of doubtful efficacy, I would not advise to have recourse to it, unless it should be found too difficult to reach the artery, at the bottom of the wound. I shall, however, in the following article, treat of the means by which this is to be accomplished.

[*Traumatic Lesions of large Arterial Trunks, Direct Compression, Ligature, &c.*

Dr. Mott believes he has seen an instance lately, in which the subclavian artery, without the scaleni muscles, may have been wounded during an operation for the removal of a small tumor above the clavicle. The wound was probably of the nature of a *small flap* on its superior surface, between the first rib and the scalenus anticus muscle. In fact, the artery was perhaps nicked in this part, as a terrific hemorrhage ensued. In this dilemma, Dr. Mott, being sent for, adopted instantly a treatment somewhat novel, but which proved eminently successful, and went to cor-

roborate his suggestion that it was the subclavian which was wounded.

The practice consisted in the immediate application of a *small portion* of compressed sponge upon the bleeding part, which was situated at nearly the depth of the forefinger. This was followed successively by other small portions of sponge, until the wound was entirely and *compactly* filled up. An entire flat piece of sponge, just the size of the external opening of the wound, was now nicely adjusted over the ten or dozen smaller pieces which had been previously impacted. Finally, a larger flat piece of sponge, of still greater dimensions than the last, was now used to cover the whole mass, and to extend some distance on every side beyond the margin of the wound.

Pressure with the hand was then made, by a succession of assistants, unremittingly for three days and three nights. After this, the pressure was confided to adhesive straps and a bandage, until suppuration made it proper to commence the removal of the sponges. This was done from day to day, with the utmost care, and by taking away piece after piece, without the least violence, until the last was separated, which was finally effected at the expiration of a week from the time that this surgeon commenced with their removal. The wound then granulated, and healed beautifully.

The advantage of the use of sponge, as a means of arresting hemorrhage, has long been favorably known; but Dr. Mott considers that its great value, in cases like that here related, consists in the application of a number of small and separate pieces, by which portion after portion, at a suitable time, may be removed, with the least possible violence to the wounded artery.

Every surgeon, who has been in the habit of using compressed sponge to arrest small and vexatious hemorrhages, must be aware of the great inconvenience and hazard of one entire large piece; for when the time arrives for its removal, the granulations are found to have penetrated into its cellular texture to such extent, that the force required to take it away, and to tear it loose from these connections, endangers a renewal of the bleeding. All of which is obviated by the successive superposition of small and separate pieces or chunks.

This treatment appears to have been so nicely adapted to the little flap or nick supposed to have been made in the subclavian in this case, and to have compressed and secured it so perfectly to its place, (as in the restitution of organs, see Vol. I.) as to have reunited its lips to the parent trunk by first intention.

Dr. Mott sees no reason, from experience and observation and the records of surgery, to doubt the possibility of such a wound, even in a large arterial trunk, being healed, without the trunk itself being obliterated, or its calibre being sensibly diminished. He is of the opinion that, if the subclavian itself in this case was not wounded, it must have been an enormous anomalous branch, close to the great trunk; for his finger, which commanded the hemor-

rhage, was upon the subclavian artery, and the first piece of sponge was passed quickly under the point of the finger itself, and there held until another was stowed away by its side. T.]

[*Wounds of the Arteries of the Foot.*

The treatment of wounds of the larger arteries of the foot, is in the opinion of Dr. Mott, a subject which has not received a sufficient degree of attention. In recent wounds for example, of the dorsalis pedis, both ends of the cut artery ought to be tied on the spot. If some days should have elapsed after the injury, it would be necessary to tie the anterior and posterior tibial arteries, and generally he has found this sufficient to arrest the hemorrhage. But in one instance where several days had elapsed after a wound of the dorsalis pedis, and in which strong compression over the wound had been made, without, however, preventing considerable hemorrhage from time to time; he found when visiting the patient some miles in the country, that though after immediately tying the anterior and posterior tibial arteries, the bleeding ceased, yet in about a week it was renewed to an alarming degree. Being again sent for, he found himself much embarrassed, not knowing whether the hemorrhage proceeded from the inter-osseal or some communicating branch of the anterior or posterior tibial arteries above where they had been tied. Thinking that it might proceed from a branch of the anterior tibial above the ligature, communicating with the trunk below, he concluded, rather than to tie the femoral, that he would cut through the *annular ligament* as near the wound as possible, and there apply a ligature, which being done had the desired effect. The patient was a wheelwright who had been wounded by an adze.

In recent wounds of the plantar arteries where some days may have intervened before surgical assistance is obtained, you cannot tie the plantar arteries themselves, and it is infinitely preferable in fact, indispensably necessary to tie *both* the anterior and posterior tibial. For Dr. Mott has several times seen after tying the posterior tibial only, that profuse hemorrhage has returned at the expiration of a week or ten days, and which could only be controlled by tying also the anterior tibial. It must be obvious to any person, that it takes some time for the collateral circulation to be established, and that when established, the reflux or distal hemorrhage may prove serious in those cases in which only one of the tibial arteries has been tied.

Dr. Mott has seen the same difficulty occur, and the same practice necessary and effectual, where the communicating branch has been cut in a wound between the *great and adjoining toe*. T.]

[*Alveolar Hemorrhage.*

Tamponing or Plugging, properly and carefully performed as in the case related by Dr. Mott, (supra,) with pieces of sponge to the

subclavian artery, will succeed, when all manner of styptics, cauteries, caustics, and ordinary modes of plugging, fail. Dr. Balaffa of the General Hospital of Vienna, appears to have acted thus very judiciously in the case of a butcher, who was attacked with one of those fearful hemorrhages which are so well known to follow occasionally extraction of the teeth, in this instance a lower carious incisor, as he had already experienced, after the extraction of another incisor in this jaw ten years before. For three days and nights the bleeding continued profuse. Brought to the Hospital, Dr. Balaffa, (see the case as drawn up by Dr. Joseph Hartmann, *Jour. des Connaissances*, &c., Paris, Oct. 1844, p. 163,) prepared a conical dosil of lint and wax (*plumasseau et de cire*) the size of which corresponded to the diameter of the alveolus: this dipped in a mixture of eau de Thédén, creosote and sulphuric acid, was adjusted firmly into the bleeding socket. Upon the top of this cone he applied a layer of the same nature, above this a second, wider and thicker, and still over that a small square plate. This arrangement adapting itself exceedingly well to the jaw, from the patient having lost the adjacent teeth on the left side, M. Balaffa ingeniously secured the whole by means of a rather narrow bandage, which was passed in a transverse direction, towards the angles of the mouth, and downward towards the chin, from which latter it was conducted to the occiput towards the vertex, finishing with circular turns around the forehead. This bandage while it firmly secured the plug, made also pressure upon it. The hemorrhage ceased and the patient slept well. On the third day after the most rigid repose the dressings were renewed, and on the sixteenth he was discharged. T.]

C.—*Compression in the Treatment of Aneurisms.*

Two kinds of compression—indirect (*médiate*) and direct (*immédiate*) have been employed for aneurisms.

I.—*Indirect Compression.*

Aneurisms of the carotid and subclavian, have been cured by Acler, by means of methodical compression made upon the tumor. Those of the ham, thigh, groin, hand and elbow, have been successfully treated in the same manner by Fabricius of Hilden, (*Bonet, Cours de Méd.*, p. 96.) Waltin, (*Ancien Jour. de Méd.*, t. LXV.,) Tulpius, (*Bibl. de Manget, ou, Obs. Méd.*, p. 305, lib. IV., cap. 17,) Platner, (*Thédén, Progrès de la Chir.*, p. 26,) De Haen, Trew, (*Ibid.*,) Plenck, Petit, Thédén, Guattani, and a multitude of others; so that we cannot call in question its efficacy; it has been employed in a great variety of ways; sometimes the compression was made upon the aneurism only; at other times on the aneurism and the rest of the limb simultaneously; in other cases on the contrary, it was only made below or above the tumor.

a. *On the Tumor or the Diseased Part.* Galen is one of the first who used compression in the treatment of aneurisms; plasters, and pieces of sponge kept on by bandages, perfectly succeeded with him in curing a patient who had the artery wounded in bleeding. At the time of Dionis, (*Huitième Demonstr.*, p. 693,) they applied upon the wound pieces of papier-maché, agaric or tinder, supported by a piece of money, then by other pieces of a larger size, so as to form a pyramid whose point would correspond to the opening of the artery; the whole being supported by an appropriate bandage. The Abbé Boudelot (*Dionis.*, edit. Lafarge, p. 697) relates that he cured himself of a false consecutive aneurism, by keeping for a year a cushion strongly pressed upon the tumor.

Since then, in the first half of the last century especially, Surgeons occupied themselves much with improving this kind of compression. Arnaud, (*Mém. de Chir.*, t. I.) Heister, Ravaton, Verdue, &c., proposed different bandages with the view of rendering it more easy and sure; each one of them proposed to modify the compressive instrument of Scultetus or the tourniquet of J. L. Petit, and all supposed that they had found the means of curing aneurisms without an operation. Foubert had a steel ring constructed of oval form, carrying upon its broadest part a plate, (i. e., plaque) [meaning doubtless a metallic plate,] provided with a cushion; the other part of the ring being perforated by a quick screw (*vis de rappel*) which was also provided with a cushion upon its extremity, so that on being applied it was intended to compress only the diseased point and the part of the limb diametrically opposite. This machine more ingenious than many others, and better than those plates of lead, silver, or iron, whether provided or not with cushions, or sponges, and which were fixed upon the aneurism by means of ribbons, straps of leather or bands, was nevertheless attended with this serious inconvenience: viz., that of being easily displaced, and of not establishing any compression, except upon a diseased and very limited portion of the artery, while it also produced engorgement of the part situated below, and was not supportable but by a small number of patients.

[*Tubular Aneurism (so called) cured by direct compression to the sac itself.*—*New Nomenclature for Aneurisms.*

A case of Tubular Aneurism has been recently cured by Mr. Luke of the London Hospital, by direct compression to the sac itself, and a new classification of Aneurisms is proposed by him.

This *tubular aneurism* as he denominates it, being to all appearance an aneurismal enlargement or dilatation of the femoral artery, and that assuming an unusually cylindrical or tubular shape, occurred in a dock laborer, aged 31, admitted in the above hospital, Feb. 19, 1845. The tumor according to Mr. Luke, (*London Medical Gazette*, May 9, 1845, No. 910. Vol. XXXVI., new series, No. 2, p. 78, &c.,) was soft and compressible, of an oblong form extending from Pou-

part's ligament, down the thigh, between three and four inches, in the direction and situation of the femoral artery ; measuring transversely immediately beneath the ligament about two inches ; having a strong pulsation perceptible when the fingers were applied, throughout its whole extent, enlarging equally in all directions at each pulsation, and capable of being entirely emptied by temporary compression. There was no sound or bruit, there was some weakness in the limb and occasional cramp in the muscles of the thigh, while all the arteries of the diseased member pulsated as normally as in the sound one, and both were of natural temperature. It came on about a year before, suddenly from lifting, as he thinks, heavy weights, and had not materially increased in size, nor given him any particular inconvenience except now and then, when he exercised, a cramp in the thigh, pulsation and slight pain in the part and coldness of the limb. On March 3d, an adhesive plaster spread on leather was placed over the tumor and the part embraced by a *spica* bandage. On the 8th of March, the dressings being removed, the tumor was found to have already undergone a considerable change. Instead of being soft and compressible and capable of being emptied of its contents, it was *hard* and *unyielding* and slightly painful on pressure. Its pulsation also had entirely ceased as well as that of all the arterial trunks of the limb, the femoral, popliteal, and anterior and posterior tibial arteries—while the foot and leg felt colder than those of the opposite limb, though not indicating any change of temperature to the thermometer. The patient stated that the first application of the bandage had produced a violent throbbing, which however, soon ceased, and nothing of the kind returned. The plaster and bandage were reapplied and the limb wrapped in wool. On March 22, the tumor was still hard, consolidated, and without any pulsation. There was apparently an obliteration of its cavity, the contents of which had undergone some diminution from absorption. Mercurial ointment spread on lint was applied, and the patient allowed to move out of bed. April 2, he walked about with greater ease and freedom than when admitted, but the pain in the calf remained. April 19, after a visit out, returned as he promised—still complained of pain in the calf, especially when going up stairs. There was also numbness of the foot at times. The circulation, says Mr. Luke, was apparently restored sufficiently for the proper nourishment of the limb, yet *pulsation had not returned in any of the arterial trunks*. The size of the tumor had undergone very considerable diminution, and the aneurism had been without doubt cured.

REMARKS.

This must be added as another to the extremely rare instances of success by the ancient process of the *cure of aneurisms by compression to the part itself*, (*Vide Velpeau, supra, in this volume, Section IV., Chap. III., Article II., § II., C. Compression,*) though the process in this case is somewhat in collision with the new and

successful mode of *alternate* and *moderate* compression on various portions of the sound trunk *above* the aneurismal tumor, as recommended by the Dublin Surgeons. (See further on below.) In an aneurism of such volume, to say nothing of its abnormal shape, some courage seems to have been required in the surgeon to revert back to the ancient direct and even forcible mode of compression to the sac itself; made with such constrictive power, too, it seems, as almost to obliterate at once the whole circulation and temperature, and consequently to become an immediate source of danger to the vitality of the limb; exposing to gangrene, &c.

The consolidation was effected almost as speedily as by the ligature, and there can be no doubt that the *river-bed* of the aneurismal sac, if it may be so termed, continued to admit constantly a gentle current through the tumor and femoral trunk to all the divisions of the latter vessel, however tardy the anastomosis may seem to have been in reestablishing the collateral circulations. The case certainly goes in every way strong in support of the principles of cure laid down by the Dublin Surgeons, (which we shall soon speak of,) notwithstanding the pressure was made to the sac itself, and in a more powerful manner rather than would seem to have been advisable. Considering however the peculiar and anomalous *tubular* form of the tumor, naturally leading to the inference that the tunics of the artery were uniformly dilated throughout the whole extent of the aneurism, and did not probably form any kind of pouch upon the artery communicating by an aperture or apertures with the trunk of the vessel, the mode adopted by Mr. Luke of making uniform compression on the whole tumor, was probably the most rational, and the case may be considered as one of those rare exceptions in which the precautions of the Dublin Surgeons not to attack the tumor itself, must be dispensed with. Had the Dublin mode been followed, though the pressure it makes would have been more moderate, there would also probably have been more danger of rupturing the tumor, from the whole of the sac constituting as it were a part of the femoral trunk, or an aneurismal dilatation of it, and from its coverings being so very thin.

It is to be regretted the final issue of this case is not yet known.

Upon the strength, however, of the pathological facts disclosed by this anomalous case of aneurism, Mr. Luke proceeds at once to propose an entire change in the nomenclature of aneurisms, and to abolish altogether the old phrases of *false*, *true*, *diffused* aneurism, &c., long since rendered objectionable by the incoherent, confused, and careless manner in which such terms are used. His proposed arrangement is:

1. *Saccated Aneurism*—where there exists the ordinary sac. This is the most common. But by some latitude of expression, and considering too the pathology of the cure as advocated by this surgeon, could not his tubular or cylindrical aneurism also be called a *sac*? The *traumatic* constitute, he says, a species of saccated aneurisms.

2. His *tubular* (spindle-shaped or fusiform, which latter term we prefer) aneurism, he makes a distinct or second species.

3. *Dissecting*, as now received.

4. *Varicose* also. These two last he adopts as they stand in the existing nomenclature.

5. *Capillary Aneurism*—a new name but not a new species—i. e., aneurism by anastomosis, (or *nacvi materni* or erectile tumors. T.)

The tubular form he says is never so *globular* as it is spindle-shaped or *fusiform*, with the long axis on the track of the arterial trunk.

In the *saccated* aneurism he leaves us to infer that there is an aperture or cut or wound or rupture in the arterial trunk, and through which the sac is formed by the current of blood thus diverted from its course. Hence from this diversion the natural tendency in such aneurisms to spontaneous coagulation and cure. Not so in the tubulated, which is one continuous expanded dilated volume of the whole trunk and mass of blood, and by which these two conditions or circumstances are in great part coincident with each other in their action and direction. Hence its greater softness and thinness, its capability of being entirely emptied, &c. Hence, too, its slow increase. This latter, he thinks, is partly owing to the force of the current in these dilated portions being by a known hydraulic principle, he says, less than that of the resistance of the tunics. Finally, these forces he supposes may be poised. This idea, to say the least, is plausible; and finally perhaps, (he might have added,) that it would result that the enfeebled current, as old age advances, would become an exact measure of power to the gradually petrifying walls of arterial tubes. A *status* appears in fact to have existed, he thinks, in the case in question.

In saccated aneurism the cure is usually imputed to the formation of a clot of blood in the artery or sac, plugging up the aperture of the sac. Mr. Luke denies this, nor do we know that any person has ever seriously advanced that this was the true and only process employed in the cure. Mr. Luke, as will be seen, accords with the more sound views long since entertained upon organic consolidations, (see views of M. Velpeau, also Jno. Hunter, Ev. Home, Sir A. Cooper, &c., Chap. II., Art. I., § III., § IV., and § V. of this volume,) and considers that of the two portions of blood found in such sacs, one *coloured* and consisting of coagulum, and usually in the centre of the sac, and the other *colourless*, (see Wardrop in the Cyclopædia of Surgery,) the latter is the one on which the curative process mainly depends. This portion mostly adheres to the interior of the sac, but the adhesions are easily separable; so that it is sometimes found wholly or partially detached, owing perhaps, he says, to causes exterior to the sac. Its arrangement of *concentric layers* is clearly recognizable, and these are sometimes but loosely connected. Mr. Luke says, “the *common explanation*” (which however we are not at all aware of,) is that they are produced by *successive deposit*, from the blood flowing into the sac; thus, says Mr. Luke, Mr. Hodgson speaking of the spontaneous cure says, “the *cavity of the sac* is gradually filled with layers of

coagulum." But does Mr. Hodgson specify by what mode? On the contrary Mr. Luke says, these layers are successive *organic depositions* (of a *membrana decidua* we suppose) from the parietes of the sac, a true *fibrinous* concretion, and very different as Mr. Wardrop (Ib.) says, from a *common clot of blood*—as the *concreted fibrine* has its interior surface smooth and polished, and there is, Mr. Wardrop thinks, and which no reasonable person as we supposed had ever doubted, a *vascular connection* between this fibrinous concretion and the sac; for the same connection in certain morbid structural changes is seen between the truly fibrinous layers of a *membrana decidua* in dysmenorrhœa, and the internal vascular villous menorrhagic or lining coat of the uterus, or between the layers of the fibrinous *finger-of-a-glove-like* tubular membrane, which forms in croup and the internal lining of the trachea, or between the layers of the similar tubular membrane sometimes seen in dysentery and the mucous lining of the colon and rectum; and in granular diseases of the kidneys, as recently discovered by Dr. Julius Vogel of Göttingen, (London Medical Gazette, May 2, 1845, Vol. XXXVI., New Series, No. I., p. 1, &c.) in his interesting microscopic investigations, the same connection is found to exist between the cylindrical *fibrinous* coagula of detached epithelium and rusty coloured granules of altered blood found in the urine in such granular diseases, and the internal lining membrane of the tubuli uriniferi of healthy kidneys, to the diameter and shape of which tubuli, these fibrinous cylindrical coagula are found to correspond exactly; all which normal surfaces pour out those fibrinous laminæ by, as M. Velpeau would say, their peculiar organic *molecular action*, as in cicatrization, first intention, &c. Mr. Luke also finds sometimes between the *colourless* layers of this fibrinous membrane or concretion in aneurisms; or between them and the sac, minute *clots* of *coloured* coagulum. These he considers conclusive evidence of their radical difference from the fibrine both in character and origin. Now Mr. Luke supposes these clots have been caught and become *insäccated*, if we may use the term, by the successive depositions of fibrine—i. e., have been entangled and inclosed in them. The presence of these minute clots seems fortuitous, and the concentric process of *intra-lamination* of fibrine, if we may make a term, continues till the whole sac is consolidated.

Finally the sac itself and its vessels are, he thinks, as all sound pathologists have ever thought, the true agents in these fibrinous formations.

These *plastic operations* of nature from without inwards, point out to us as Mr. Luke justly remarks, that we ought so to conduct our treatment as not to interfere with her efforts; hence the wrong practice of depletion and low diet, thereby diminishing the vital power of the blood, withholding and abstracting from it its fibrinous qualities, and incapacitating it from accomplishing such salutary depositions of this indispensable material for consolidation.

Such views are just; but we are sure Mr. Luke has omitted to examine the authors of other times, or he could not have imagined

that he or Mr. Wardrop were advancing a *new* doctrine in the plastic pathology of aneurismal consolidations. So true is it that the past and all who laboured so gloriously and arduously in it are soon forgotten, and that the *debris* of their reputation build up, like molecular action itself, that of the successive generations who follow. T.]

b. On the whole extent of the limb. Compression on the whole length of the diseased limb has therefore seemed preferable to local compression. Gengha practised it in the following manner. I make, says he, on each finger an expulsive bandage by means of a small band; then I envelop the hand and fore-arm in the same manner nearly up to the wound; I place on this last a large tent (tampon,) (which word now means a *plug*, T.) of fine linen, saturated with a melange of red earth, (*terre sigillée*,) Armenian bole, dragon's blood, (*sang-dragon*,) hæmatite stone, plaster, white of egg, and plantain; I apply over that a layer of thick lead, some compresses, and three or four turns of bandage till it reaches above the elbow; afterwards by means of the same bandage I fix upon the track of the artery, on the inner side of the arm, a cylinder of wood, enveloped in linen to serve as a splint; I then bring my bandage upon the wound to fasten it there by a few more turns; after which I moisten this bandage with an astringent liquid, and put the patient under a very restricted (*tenu*) and cooling regimen.

This, with the exception of the cylinder of wood, is what is generally known at the present time under the name of the bandage of Thêden, (*Progrès ultérieure de la Chir.*, etc., p. 27,) who moreover made application to the tumor of compresses saturated with *eau vulnêraire*. In this manner there is less to apprehend of infiltration in the limb; the pain is less acute and the compression more easily supported; but the circulation of the collateral or supplemental arteries is thereby rendered much more difficult than by the other method, and so much the more so as we are obliged to make the compression with so much the greater force.

c. Below the Tumor. According to Boyer, (*Boyer, Mal. Chir.*, 2d édit., t. II., p. 157,) a military surgeon, named Vernet, had conceived the design of curing aneurism of the limbs by establishing a point of compression on the course of the artery below the tumor. Vernet tried this method on a patient affected with inguinal aneurism; but the pulsations in the sac increased with the greater force, and the author felt himself compelled to renounce his invention; it is a method which has generally been censured, even by those who adopt the ideas of Brasdor for the ligature, but which nevertheless does not appear to have merited unqualified proscription. If, for example, we had to treat an aneurism above which it would be impossible or at least exceedingly dangerous to apply a compressive dressing or a ligature; and if, on the other hand, no important branch was given off between the cardiac extremity and the free part of the tumor, it does not follow that by compressing the artery upon the other side of the tumor, we might not succeed in interrupting the circulation in the aneurism, promoting the for-

mation of a solid coagulum in its cavity, and ultimately effecting the obliteration of the arterial canal and a perfect cure.

d. Above the Tumor. Remarking that the bandage of Thédén, that of Guattani, and all the machines for partial compression tend to interrupt the collateral circulation in the limb, or to induce the rupture of the aneurism, if it does not yield to their action, surgeons at an early period directed their attention to some mode of compressing the diseased artery at the point where it is most superficially situated, between the tumor and the heart. M. Freer (*Caza Mayor, Thèse No. 151, Paris, or, Observations on Aneurisms, 1807*) has greatly extolled the bandage of Sennefio, designed for this object. This practitioner first surrounded the whole extent of the limb with a roller bandage moderately tightened, (*serré*.) and afterwards placed a small cushion at some inches above the tumor. A plate was applied to the opposite surface of the limb, which he surrounded with a tourniquet in such manner as to enable him to press the artery upon a single point by means of a screw. At the expiration of a few hours, says M. Freer, the limb becomes œdematous and tumefied; after which the tourniquet may be removed, and no other dressing used but a cushion and a bandage applied sufficiently tight.

This bandage, which is a combination of those of Thédén and Foubert, might, as it appears to me, be employed with some prospect of success. Dubois, (*Bullet. de la Facul. de Méd., 6e année, p. 40,*) a long time ago, effected the cure of an aneurism of the thigh, by making use of a species of spring, constructed upon the principles of the tourniquet of Petit, and which acted only on two narrowly circumscribed points of the limb. Albert of Bremen (*Caza Mayor, Oper. cit.*) obtained similar success from a bandage which he calls the *inguinal compressor*, which is composed of a pelote intended to be applied against the pubis on the track of the femoral artery, and of two leather straps, (*couroies*) which embrace the whole circumference of the pelvis and the upper portion of one of the thighs. M. Verdier (*Appareil Compressif de l'Art. Iliaque, 1822*) effected the same result by means of a bandage which has some analogy with the hernia bandage of Camper. Dupuytren (*Bullet. de la Fa. ult., t. VI., p. 242*) had another constructed, which is composed of a semi-circle of solid steel, surmounted on one side by a broad, thick, and concave pad (*coussinet*) which was to be applied upon the surface of the limb opposite to the artery; and having on its other extremity an iron plate which, by means of two uprights, (*montants*) and a quick screw, sustains a rounded pelote, which was to be applied to the artery, and could be made to approximate or recede from the other pad at pleasure. By means of a species of dog-collar, (*collier de chien*.) making compression above the tumor, M. Viricel (*Bullet. de la Facult., 6e année, p. 132*) has effected in the hospital of Lyons unquestionable cures. The author of an ancient thesis (Morel, *Thèse de Strastourg, 1812*) asserts that we should succeed yet better, if the compression were made at the same time upon many points of the limb. This last precaution, the sugges-

tion of which has been contested by MM. Leroy (Depot. à l'Institut, 1830.—*Gaz. Méd. de Paris*, 1835, p. 202, 239) and Malgaigne, (*Thèse de Concours pour la Clin. Chir.*, 1834,) is described with care, and warmly extolled by M. Guillier de la Tonche. (*Thèse, Strasbourg*, 1835.) Finally, M. Blizard, and M. A. Cooper (S. Cooper, *Dict.*, etc., trad. Franç., p. 120) have employed another instrument, not less ingenious than those that have been mentioned. A long piece of steel is first adjusted to the outer side of the knee and the great trochanter; from the middle of this piece there proceeds another which advances in a half circle towards the femoral artery, and carries upon its extremity a plate provided with a pad, capable of being moved by means of a screw, and of compressing the artery with such force as to cause a cessation of pulsations of the aneurism without interrupting the circulation in vessels of less calibre.

The compression employed in this manner may without doubt succeed, and should be had recourse to in some cases, for example, in aneurisms of the neck, of the subclavian artery, and the upper part of the femoral, if from any cause whatever, we were prevented from using the ligature; in other cases, it is certain it will but seldom answer. The patient of whom M. Cooper speaks, could not support it but a very few hours. In one of those whom Dupuytren treated, it became necessary to shift the bandage successively to different points of the artery, and in a short time to lay it aside altogether. M. Roux relates a similar case, and in the patient mentioned by M. Verdier, it required all the constancy and resignation that he exhibited, not to reject the apparatus, a few days after having begun the use of it. To obtain moreover every advantage possible from it, we should associate with compression, a rigid regimen, and also topical refrigerants or astringents. It has, I know, succeeded without these adjuvants, even in persons who persisted in using violent movements and the most fatiguing exercises. Lassus (*Médecin. Operat.*, p. 452) speaks of a man who, after having applied to an aneurism in the ham a bag filled with salt, fastened by four long bandages of linen, and then effected compression upon the artery of the thigh, imagined that he could accelerate the cure by making every day a forced march, and taking far more exercise than he had been accustomed to, and who, in fact, ultimately succeeded by this means, after the expiration of eight months, in curing himself of the disease; but the surgeon must not take exceptions like these for his guide.

c. Appreciation. If the compression did not at the same time act upon the veins, and also occasionally upon the nerves, if it were true that it would at least prepare the way for the application of the ligature, by forcing the collateral arteries to dilate, and that it was never attended with danger, we should undoubtedly be wrong in neglecting to have recourse to it under all circumstances; but the ligature in these latter times has been rendered so easy and simple in its application that we can no longer, in reality, place any great degree of reliance upon other means.

Even up to the time of Scarpa, compression had been warmly advocated, because in conformity with the prevailing doctrines of J. L. Petit, (*Acad. des Scienc.*, années 1731, 1732, 1735,) it appeared to be naturally calculated to effect a cure of the aneurism without obliterating the artery. When the blood is arrested, says Foubert, the wound upon which a sufficient compression has been made closes up; the skin, the fat, and the aponeurosis cicatrize; the wound in the artery, however, does not unite primitively, but leaves a round aperture occupied by a clot of blood (caillot.) If the compression is continued for a sufficient length of time to effect the induration of this clot, the patient is radically cured; but if we allow the arm to be moved before the clot has acquired sufficient solidity to complete the adhesion of the tissues, it escapes from the opening, and the blood insinuates itself around it, and detaches it from the place it occupied. It has since been ascertained, however, that cures thus obtained were not radical; that the clot which constitutes a kind of cork (*bouchon*), or nail, (*clou*), as J. L. Petit called it, and which fills up the opening of the artery never becomes identified with the tissue of the vessel; that sooner or later it is driven out, and that the aneurism then returns. Thus, in the case related by Saviard, of an aneurism at the bend of the arm, the patient, to all appearance, had been cured for the space of near fifteen years, when, in consequence of some effort made, the tumor returned. It is, therefore, useless to hope for the cure of aneurism by any other mode of compression than that of the obliteration of the artery.

This point being conceded, it remains only to ascertain which one among the methods that have been proposed is the most suitable for effecting this result. Scarpa thinks it absolutely necessary that the two opposite walls of the canal should be placed and kept in contact during a certain length of time, but that the compression upon the tumor effects this result with difficulty; consequently he advises us to act above the tumor, except, however, in cases of recent traumatic aneurisms. Experience does not corroborate the opinion of Scarpa. Guattani has cured four aneurisms out of the fifteen which he treated by applying his bandage upon the tumor itself. Flajani has obtained the same proportion of cures, under the same circumstances, and every day we still hear of the announcement of similar results.

The *aneurismal varix* (*varice anéurismale*) so well described by Guattani (*De externis aneurismatibus*, etc., 1772) and W. Hunter, accommodates itself much better than any other kind of aneurism to the compressing bandage, and is often cured by this application. The two Brambilla and Monteggia, each relate an example of this kind; it is, at least, a palliative remedy, even though it may not succeed in accomplishing a radical cure. An elastic sleeve, or a simple laced stocking arrests the progress of the disease, and gives to the limb the power of fulfilling its customary functions, without exposing the patient to the slightest risk of danger. A lady thus treated by Scarpa, wrote to this

surgeon at the expiration of fourteen years, that she experienced no other inconvenience in the affected arm, except occasionally a slight degree of numbness, (engourdissement.)

If Cleghorn, instead of advising his patient to change his trade of shoemaker for that of barber, that he might be enabled to hold his arms elevated, had employed compression, he would, without doubt, have obtained the same advantage from it. But inasmuch as the state of the patient of whom Hunter speaks, had not, after the lapse of thirty-five years, grown any worse, that in three several cases Pott did not feel himself obliged to perform the operation, and that B. Bell, as well as Bertrandi, and many others have seen the same result, prudence recommends that in cases of aneurismal varix, we ought, before proceeding to the ligature, to make trial of compression. A man who has an aneurism of this kind in his thigh since 1813, and whom I have had an opportunity of seeing during the space of two months at La Charité, has never worn a bandage, and is scarcely sensible of his infirmity.

If we wish only to support the parts, the laced stocking, or the simple roller bandage of Thédén suffices; but if our object is to obtain a radical cure, compression requires other precautions to be adopted, the same, in fact, as for other kinds of aneurism, that is to say, that in addition to the roller bandage carefully (exactement) applied from the free extremity to the upper part of the limb, where it is to be fastened by one or two turns (anses) of spica around the trunk, it is requisite that we should previously place upon the tumor, supposing that a tumor exists, some lint, sponge, or graduated compresses, saturated with cold and repellant (répercussives) liquids, and that we should apply a long compress (longuette) over the track of the artery between the wound and the heart, and adjust over that, after the method of Senneffio, a special compressor, one for example, like that of Foubert or Dupuytren.

Wherever these aneurismal arteries rest upon bones or other solid parts capable of furnishing them with a sufficient point d'appui, and where they are not separated from the surface of the body but by the common integuments, the aponeurosis or cellular tissue, compression offers every possible advantage, and should be frequently had recourse to, in conformity with the rules laid down in the chapter which I have devoted to this subject above.

[The Newly Improved Method of Curing Aneurisms by Pressure above the Tumor, (i. e., on the cardiac side of it,) and without Obliteration of the Artery.]

The cure of aneurisms by *pressure*, applied in a more ingenious, methodical, and philosophical mode than by any of the ancient processes above described in the text by the author, has lately been revived by some surgeons of Dublin, and been followed by such happy results, as have attracted the general notice of the pro-

fession. The actual present condition of our art in relation to this method, and its vast improvement upon the imperfect, painful, and unsatisfactory contrivances hitherto employed, is so well described, so clearly explained, and judiciously commented upon, in the recent work on the Principles of Surgery, by Professor Miller of the University of Edinburgh, (with the exception that, recent as his notice is, it does not embrace the *greatest improvement of all*, and which has been established within this present year,) that we cannot do better, previous to a more particular description of the lately adopted, still more greatly perfected, mode of conducting the process and of applying its apparatus, than transfer his remarks to this place: "In ancient times, the surgeon who was afraid to cut into the aneurism and take his chance of arresting the flow of blood, had recourse to *direct and energetic compression of the part*, with the hope of cure. The name of Guattani is chiefly associated with the practice. Local sloughing, suppuration, or ulceration, with severe constitutional disturbance, yet with an unclosed artery and aneurism, resulted more frequently than the cure. Subsequently to the establishment of the Hunterian operation, its principle was extended to the mode of treatment by pressure; this being applied not to the tumor itself, nor in its immediate vicinity, but *at some distance*—at a part such as would be selected for Hunterian deligation, in the hope of the arterial tissue there being in a sound condition. This method was made trial of by Dubois, A. Cooper, Blizard, &c., but with no satisfactory issue. The pressure was continued and severe, *their object being to keep the tube close at that point, and by plastic deposit, to obtain its complete consolidation*. The result was the occurrence of great pain and constitutional disturbance, followed by inflammation, ulceration, or sloughing of the compressed parts—exposing or perhaps including the vessel. The practice found no favor with the general profession. Lately, however, the treatment by pressure has been revived in a more scientific form, and with a better success—conducted rather as if itself were not the agent of cure, but only the means whereby the spontaneous cure may be originated and favored. The pressure is made at a Hunterian site as before, but is *neither constant nor severe*. By means of a compressor, such as invented by Crampton and Signoroni, or any other suitable application, a moderate degree of pressure is applied to the vessel, at a point where its coats may be expected to be sound, and consequently not prone to ulcerate from slight causes. This is maintained *so long as it can be conveniently borne by the patient, but no longer*. So soon as the uneasy sensations become at all intense, with swelling and numbness of the limb, and throbbing in the part, the pressure is either slackened or altogether removed. *After a time, the parts having recovered, it is reapplied; again it is removed*; and thus, by its *occasional* and modified use, the disasters formerly attendant on the treatment by pressure may be altogether avoided. At the same time, the circulation in and near the aneurism is decidedly moderated, so as to favor solidification.

The tumor is not only arrested in its growth, but begins to diminish; its pulsation is less, and its dimensions contract; it feels harder and less compressible; *ultimately pulsation wholly disappears, and induration is complete*; absorption then advances, and the *obliterative cure* is obtained, with or without a previous condition of the vessel. But the pressure is not trusted to alone. The same preparatory treatment is necessary as before the operation by ligature; and throughout the whole period of treatment, absolute repose, with recumbency, is maintained, as well as antiphlogistic regimen and all other means likely to favor the desired beneficial change. Also *the limb below the compressed point must be uniformly and equably supported by bandaging*, lest passive congestion and œdemas supervene; and this pressure may from time to time be somewhat increased on that part of the limb which includes the aneurismal tumor. Let no haste be indulged in. The process is necessarily one of weeks, not of days; gradual, not sudden; interrupted, not continuously progressive. *The pressure requires to be neither great nor constant; for we do not desire obliteration, even temporary, of the arterial tube there; it is sufficient to moderate—not essential to obstruct the flow*; and only by a constant remembrance that such are the principles of cure by this means, will the pressure be so leisurely and prudently conducted as to ensure avoidance of the disaster to which compression is liable. The advantage of such a mode of treatment, when properly conducted, is immunity from ulceration and hemorrhage; the disadvantages are, the protracted period and ultimate uncertainty of cure. If improperly conducted, it is in every point of view inferior to the ligature, less certain of cure, and even more certain of danger at the selected part of the vessel. Even skilfully managed, it is obviously less capable of general application, there being not a few systems possessed of an intolerance of pressure, even when modified and occasional. The improved revival, however, is as yet but in its infancy. In the hands of Liston, Cusack, Hutton, and others, it has already succeeded. But a wider experience is still required, ere surgical opinion can be at rest upon the question. The leading points of the system, it may be again stated, are: The pressure is at some distance from the tumor, moderate, and only occasional; it is not necessary, and it is not our object to obliterate the vessel at the compressed point; in other respects the same treatment is followed out, regarding both part and system as in the favoring of spontaneous cure without any surgical interference. (*Principles of Surgery*, by James Miller, F.R.S.E., &c., Professor of Surgery in the University of Edinburgh, &c. Edinburgh, 1844, p. 457, 459.)

Truly we are now enabled to add, that when the above was published, (last year only,) the process, though it had made such advances since its revival at Dublin in 1842, was still in its *infancy*; as the greatly improved plan now, it may be said, so far satisfactorily established, by the surgeons of the Irish capital, within the last twelve months, goes far to make this mode of treatment one of

the most invaluable discoveries (for its present perfection makes it a *discovery*) in the annals of surgery.

As it may be justly thought, therefore, by some, that the Professor of Edinburgh above quoted may have expressed himself with rather too much caution, or, in other words, somewhat doubtfully of the brilliant picture anticipated by the Dublin Surgeons in the substitution of their improved modes of applying the ancient process of indirect compression for aneurism, we feel obliged, as well by our own favorable impressions as from a strict sense of justice to our brethren of Dublin, and to the profession at large, to lay before them a full, clear, and, to all appearance, impartial *résumé* of all that has been achieved up to the present moment by this process. It was first introduced or revived by Dr. Hutton, of the Richmond Hospital, Dublin, for popliteal aneurism, and the last perfection given to it consists in those most important improvements made in the instrument or choice of instruments used for compression, and in the now just-adopted and most successful and philosophical principle upon which, according to axioms of sound physiology and pathology, that pressure, as happily elucidated by Dr. Bellingham, should be applied. We therefore take great pleasure in availing ourselves freely of the excellent paper of this eminent Irish surgeon, who himself has been one of the most successful in this new treatment; we mean Dr. Bellingham, one of the surgeons of St. Vincent's Hospital, Dublin. (Vide *Dublin Journal of Medical Science*, May 1, 1845, art. 5, p. 163, 176.)

After enumerating the well known objections and dangers of ligatures upon large arteries, such as phlebitis, gangrene, &c., Dr. Bellingham alludes to the language he used in bringing this subject before the *Surgical Society* of Dublin, some years since, and after, as we believe, the first successes of Dr. Hutton. Upon that occasion, says Dr. Bellingham, I observed "the application of well-regulated pressure in the treatment of popliteal aneurism, cannot but be looked upon as a most important improvement in surgery. The operation of tying the femoral artery is, perhaps, the least successful of that of any of the larger arteries; and when *three cases* have occurred in succession, in three different hospitals, within a short period, it is not too much to expect that the necessity for performing this operation will in future be much diminished. This result, however, must depend upon the trial of compression in a larger number of cases; though its success in these offers great encouragement to surgeons to attempt it, inasmuch as the difficulties which hitherto surrounded it, in the imperfect construction of an instrument for the purpose, *have been in a great measure overcome, and the correct theory of the mode of action of compression, and the amount of pressure required for the success of its application, have been nearly established.*"

"That I was not then over-sanguine," continues Dr. Bellingham, "has been shewn by the subsequent results of this mode of treatment; and the success which has attended the treatment of aneurism by compression, may be judged of by the following list

of cures which have been effected since its *introduction* by Dr. Hutton, in November, 1842. The cases are arranged, as nearly as possible, in the order of their occurrence.

Cases of Popliteal and Femoral Aneurism, cured by Compression, between November 1842 and February 1845.

1. Dr. Hutton, Richmond Hospital, Dublin, popliteal aneurism.
2. Dr. Cusack, Stevens's Hospital, Dublin, popliteal aneurism.
3. Dr. Bellingham, St. Vincent's Hospital, Dublin, popliteal aneurism.
4. Mr. Liston, University College Hospital, London, femoral aneurism.
5. Dr. Harrison, Jervis-street Hospital, Dublin, popliteal aneurism.
6. Mr. Liston, University College Hospital, London, femoral aneurism.
7. Dr. Bellingham, St. Vincent's Hospital, Dublin, femoral aneurism.
8. Dr. Kirby, Jervis-street Hospital, Dublin, popliteal aneurism.
9. Dr. Allan, Royal Naval Hospital, Haslar, popliteal aneurism.
10. Mr. Greatrex, assistant surgeon, Coldstream Guards, popliteal aneurism.
11. Dr. Cusack, private patient, Dublin, popliteal aneurism.
12. Dr. Porter, Meath Hospital, Dublin, popliteal aneurism.

Eight of these twelve cases were treated in Dublin; and in all the cure has been permanent. The aneurismal tumor, in a few instances was of very large size, and in a few the operation by ligature would very probably have failed, owing to the diseased condition of the vessel, or some other cause. In the history of the cases it is noticed that the femoral artery could be traced after the cure, to near the sac of the aneurism; *proving that the artery is never obliterated at the point compressed.* Dr. Bellingham had already remarked (*Dublin Journal*, vol. XXIII., p. 465,) that such an amount of pressure as would obliterate the artery is never necessary; and *that a cure would be more certainly and more quickly brought about, by allowing a feeble current to pass through the sac of the aneurism, than by completely checking the circulation in the vessel.* As this principle, says Dr. Bellingham, appears to have been established by the results of the cases which have occurred in this country since, I shall now merely quote what I then said upon the subject: "When it was considered absolutely necessary for the success of compression, that such an amount of pressure should be applied as was almost certain to occasion sloughing of the part, and very certain to occasion intense pain and suffering to the patient; and when, in addition, this was to be prolonged through five successive nights and days, we can readily understand why patients refused to submit to it; and we can easily account for the disrepute into which the practice fell, and for the unwillingness of surgeons to adopt this treatment in preference to the simple operation of placing a ligature upon the femoral artery. It would appear, however, that it is not at all essential the circulation through the vessel leading to the aneurism should be completely checked, but *rather the contrary*: it may perhaps be advantageous at first,

for a short period, by which the collateral circulation will be more certainly established. But the result of this case, if it does no more, establishes the fact, that *a partial current through an aneurismal sac, will lead to the deposition of fibrine in its interior, and cause it within a few hours to be filled and obstructed, so as no longer to permit of the passage of blood through it.* Pressure, so as altogether to obstruct the circulation in an artery, must *necessarily be slower in curing an aneurism*, as it must in some measure, act by causing obliteration of the vessel at the part to which the pressure has been applied; whereas a partial current through the sac, enables the fibrine to be *readily entangled* in the parietes of the sac in the first instance, and this goes on increasing, until it becomes filled; the collateral branches having been previously enlarged, the circulation is readily carried on through them.’

No reasoning, in our view, could be sounder than these arguments of Dr. Bellingham, or in more perfect conformity to the gradual and simple evolution of the laws which nature herself always observes in all her organic processes. For it is obvious that the sudden and instant interruption to the course of blood in the large trunks, must necessarily be attended with serious danger, in a great variety of ways, and that the *true secret* of cure by compression seems at last to have been reached by following nature herself in her modes of accomplishing her purposes, whenever she chooses to bring about the obliteration of vessels. Thus the very partial stream itself more slowly moving through the dilated pouch in proportion to the greater calibre of the latter, (as Mr. Luke remarks—see above,) not only continues to supply increments of plastic fibrine to the internal chorion-like, shaggy lining of the diseased tumor, but to favor its entanglement, deposition and consolidation there, as so clearly explained by Dr. Bellingham. (See also the admirable explanations and descriptions of these natural organic processes by Prof. Velpeau, in this and the preceding volumes of this work.) But we are anticipating this surgeon. ‘It is deserving also of remark,’ he continues, ‘that in the cases which have been detailed in full, an enlargement of the articular arteries about the knee, coincided almost with the cessation of pulsation in the tumor. This increase in size in the anastomosing vessels, shewing that collateral circulation is becoming established, is obviously a very favorable sign; and if it occurs early during the treatment, we may look for a speedy cure, as it indicates the filling up of the aneurismal sac.’

The principal improvement which has taken place in the treatment of aneurism by compression, consists in the *mode of applying the pressure*; that is, instead of employing a single instrument, we employ two or three, if necessary; these are placed upon the artery leading to the aneurismal sac; and when the pressure of one becomes painful it is relaxed, the other having been previously tightened; and by thus alternating the pressure, we can keep up continued compression for any length of time. By this means the

principal obstacle in the way of the employment of pressure has been removed; the patient can apply it, with comparatively little inconvenience to himself; time will not be lost owing to the parts becoming painful or excoriated from the pressure of the pad of the instrument; and as the pressure need not be interrupted for any length of time, the duration of the treatment will be necessarily considerably abridged.

"Some of the success," continues Dr. Bellingham, "of the improved method of applying pressure must, however, be referred to the improvement of the instrument used. That which I employed, (made by Millikin of Grafton street, Dublin,) is a modification of a *carpenter's clamp*, which was invented by a patient under Dr. Harrison's care, for popliteal aneurism, whom I had the opportunity of seeing several times, both while under treatment and after a cure had been effected. It consists of an *arc of steel, covered with leather*, at one extremity of which is an *oblong padded splint*, the other extremity terminating in a *nut containing a quick screw*, to which a *pad* similar to that of the *tourniquet* is attached. The principle of this instrument is exceedingly simple, so much so, that the patient can regulate its application himself; and it can be made of every size, so as to compress any vessel within the reach of compression. It appears to be a much superior instrument to that which was employed in the treatment of the cases in the London hospitals, the application of which cannot be maintained for any length of time without occasioning severe pain."

§ I.

The advantages of Compression over the Ligature in the treatment of external aneurism, are, as enumerated by Dr. Bellingham, as follows:

a. There is not the slightest risk to the patient, and it is exempt from all danger; which of itself, on the score of humanity alone, is an argument of great weight; but when connected with the fact that the cure has been complete in every case where the process has been carried out, it becomes, in comparison with the ordinary mode by the knife and ligature, inestimable.

b. Pressure is applicable to certain cases of aneurism, where the ligature is not, or when the ligature would be likely to be followed by unfavorable results. Thus, large sized aneurismal tumors act injuriously by pressure on the collateral circulation, both the veins and arteries, sometimes obliterating the latter, and causing, as a general result, from this obstruction, œdema of the limb below, or on the application of a ligature under such circumstances, very probably gangrene. Whereas this cannot happen from the treatment by pressure, which acts as we have already remarked, *slowly and gradually*, giving time for nature herself to accommodate her own laws to this mechanical modification, applied to them, and which pressure moreover, can be interrupted at any time, or removed, being perfectly within our control.

c. Dr. Bellingham, indeed, is of opinion that pressure would be likely to succeed more generally in curing a large than a small aneurism, inasmuch as the lining of the sac of a large aneurismal tumor, is generally rougher and more irregular than that of a small one; it will therefore more readily entangle the fibrine of the blood, which is allowed to flow through it. Moreover, in several of the examples of aneurism, cured by compression, which have been published, the tumor was of a large size.

d. Again, when an aneurism has attained a large size, if its contents are principally fluid, and its parietes are much thinned, inflammation and suppuration of the sac very commonly follow the application of the ligature, which may bring the patient's life into danger, and at best must render the recovery very tedious. This has never occurred yet after the use of compression, and such a result is evidently much less likely to follow it. Mr. Cusack's last case of popliteal aneurism cured by compression, is an example in point; the tumor was of large size, the circumference of the limb at its seat, being five and a half inches greater than on the opposite side; its parietes were so much thinned that "great apprehensions were entertained, lest they should give way;" the limb was likewise œdematous; and yet every thing proceeded as favorably as could have been desired, and the cure was completed within a shorter period than in several of the other cases which have been related. Mr. Liston's second case of femoral aneurism cured by compression, is also a good example; here the aneurism is stated to have been no less than *sixteen inches in circumference*.

e. Aneurism not unfrequently occurs in individuals in whom the coats of the artery between the tumor and the heart are so much diseased, that the vessel, instead of taking on the adhesive inflammation after the application of the ligature, ulcerates; or the ligature cuts its way through, (causing often dangerous if not fatal secondary hemorrhage where such diathesis of arterial degeneration exists—T.) or aneurism may occur in subjects laboring under vascular or other disease of the heart. In such cases the operation by ligature is contra-indicated, and would almost necessarily fail; whereas pressure may be applied with the same prospect of success as in subjects in whom the heart and arteries are perfectly healthy. In one of the earliest cases of popliteal aneurism treated by compression, since its *re-introduction* by Dr. Hutton, the patient was not considered a favorable subject for operation. We question, however, if Dr. Bellingham may not be a little too sanguine on this point, in cases where an actual arterial degeneracy or a general vitiated tendency in the structure of the great trunks exists. Here, as we conceive, general or *internal constitutional* treatment, were any such ever to be brought to light, for such organic maladies, and which the recent brilliant discoveries by Leibig and others on the constituents of the blood and its secretions, and the functions of the heart, arteries, and other vessels and organs, would encourage us to believe should consist in all those kinds of nutriment that would increase the amount of the plasti:

or gelatinous products of nutrition, and diminish the earthy and uric deposits, would come in as admirable therapeutic adjuvants to the humane and *bloodless* surgical discoveries, on the cure of aneurism by compression. While the enlightened principles of the Dublin School of Surgery, regardless of the éclat of dazzling triumphs with the knife, looks disinterestedly and with a noble feeling worthy the chivalry of the Irish heart, to the great ends of philanthropy, by devising all modes of ingenious mechanical apparatus that can be found as substitutes for cutting instruments, in the same way that mechanical art has been made so subservient in this respect to the almost miraculous and also bloodless conquests of myo-tenotomy, so we repeat may the rapid and unanticipated progress of rigid analysis as applied to the living organic elements of the human body, under the auspices of German, French, and British chemists, constitute and create a new era in physiology, pathology, and therapeutics, that may in time supersede the harsher expedients of chirurgical science in the great and yet imperfect department of aneurismal as well as other diseases.

f. Dr. Bellingham, however, in his defence of this new process, as its wonderfully improved modes entitle it to be called, continues thus : " Pressure is applicable to cases of the aneurismal diathesis, and when more than one aneurism exists at the same time ; cases in which the operation by ligature is likewise contra-indicated ; as well as to cases of *spontaneous aneurism* occurring in individuals of intemperate habits, or of broken down constitution, in which the surgeon with great reluctance would perform any operation." We would apply to this part of Dr. Bellingham's arguments the same remarks we have made upon the last subdivision.

g. A few cases have been related in which the operation by ligature failed, in consequence of some irregular distribution of the artery above the aneurism. Now in such cases, compression promises to be equally effectual as in any other.

h. Again, cases occasionally occur where the patient has too great a horror of the knife to submit to its application on any conditions, but would readily conform to the mild and more natural, and to all men's senses more rational, process of compression. Indeed it may be said, remarks Dr. Bellingham, to have been this *accidental circumstance* which led to the recent re-introduction of compression in the treatment of aneurism.

i. Lastly, if pressure should fail to cure an aneurism, (which from the results hitherto observed is very unlikely,) its employment will not preclude the subsequent operation by ligature ; but by retarding the increase of the aneurism, and assisting in the establishment of the collateral circulation, it would tend rather to render the chances of the operation by ligature more favorable. This undoubtedly is a very solid argument which cannot be gainsaid, and considering the now *perfected* and almost *painless* mode of employing continued pressure, as at last established by the persevering and honorable efforts of the Dublin Surgeons, no practitioner would be justified, in any case to which this method could

be applied, in withholding a full and fair trial of its powers before proceeding to the knife.

§ II. *Objections to the Treatment of Aneurism by Pressure answered.*

Dr. Bellingham continues :

a. That the arteries are few in number to which this treatment can be applied ; but what is really the fact ? The artery above all others, in which aneurism is most frequent, after the aorta, is the popliteal, and next in frequency come the femoral and brachial. Lisfranc has given a table of 179 cases of aneurism, (exclusive of those of the aorta,) collected from various works, and of this number there were 59 cases of popliteal aneurism, 17 of the carotid, 16 of the subclavian, and 5 *only* of the external iliac. But even this must be much below the average, for few cases, comparatively, of operations for popliteal aneurism have been published, (owing to its frequency,) unless there happened to be some peculiarity in the case ; whereas most of the operations upon the iliac, subclavian and carotid arteries, have been brought before the profession, on account of the infrequency of the disease in those vessels. It must be recollected also, that aneurism of the subclavian or carotid arteries, near their origin, and of the common iliac or innominata, *which do not admit of the application of compression, do not admit either* of the employment of the ligature. It surely therefore ought not to be urged against this method, that because aneurism occurs in arteries beyond its reach, we should refuse to apply it to vessels to which it is adapted ; or that the practice should be denounced, because it is not applicable to every vessel.

We do not despair with Dr. Bellingham, such is the *prestige* in our view of the new mode, that it may not yet come to be applied both to the arteria innominata and common iliac. To the *abdominal aorta* trunk we have had within a few years ample proof of the value of pressure in the saving of life in formidable uterine hemorrhage, and the ligature itself on the innominata has proved in the hands of Dr. Mott, and others who succeeded him in that operation in surgery, the incontestable truth that life and all its functions may be prolonged for three or more weeks after the *sudden* interruption of at least *one-third* of the whole column of blood thrown from the heart. Nor is it by any means established, since the number of times that a ligature has been placed upon the innominata is now only *six*, and that, as an offset, if we please, to the twelve cases of complete cures by pressure, (vid. list above,) all these innominata-ligature cases have without an exception ended fatally ; that some more skilful mode of curing aneurisms beyond the trunk of this vessel may not yet be devised by some more fortunate surgeon than those who have hitherto attempted it. Moreover if it be now certain that life, and the whole organization can be thus sustained after so great a concussion as this may be termed to be, upon the hydraulic movements of the vital current, and if compression shall come to be substituted for the knife, why may not the day arrive

on the other hand, where the knife itself, in cases where pressure cannot be applied, might not be brought into use perhaps as an adjunct to carry out the very principles of compression. Thus it has suggested itself, that some plan may yet be devised by which indirect pressure could be made to include the innominate and its immediate cellular connections, and by which a graduated and exceedingly moderate force would, instead of ulceration, promote the thickening, granulation, cicatrization, and consolidation of the surrounding tissues, so as to bring about a gradual approximation of the tunics of the artery, and a corresponding diminution in the calibre and volume of blood in its trunk. This suggestion may seem to be almost chimerical, if not fanciful. In the strides, however, that surgical science and human ingenuity are daily making, it would seem that there should be no hypothesis, however absurd, that might not be indulged in as a stimulus at least to the new application of the laws of ascertained scientific truths, or to the discovery of new laws and truths. *Acupuncture* too, perhaps, and *electro-puncture* which have not, as it seems to us, kept pace with the progress of surgery, may be destined in this age of astounding discoveries in *electro-magnetic science*, to be employed as a means to effect by a gradual process, the partial consolidation of the plastic and fibrinous portions of the blood in all aneurismal tumors wherever situated, and upon which result after all, the *whole treatment* by compression, (and by the ligature also it may be said,) *ultimately reposes*, as constituting the great law of *vascular obliteration* which nature herself has adopted and follows. (See *acupuncture* and *electro-puncture* as considered by M. Velpeau in this and the preceding volume.)

The experiments of physiologists and chemists, skilled in researches into organic life, might also, we should suppose, be well combined to discover some mode different from any we have suggested, and far more efficient than the above improved method of compression itself; whereby, through means of *sub-cutaneous* or *sub-tunic puncture*, for example, and *some stimulating injection as well as electro-puncture*, aneurismal tumors and pouches might, together with the auxiliary means of pressure on the trunks leading to them, be made to have their contents *gradually consolidated* throughout the whole extent included within their *parietal coverings*. For this, we repeat, is the great principle to be constantly kept in view in our investigations, and which the above remarkable cures by pressure have fully established. We see what chemistry, by means of *electro-magnetic* agency, is now doing in the arts by the coating and embossing of substances with metallic precipitates; and though we are far from looking upon the vital fluids, canals, and tissues as inorganic hydraulic tubes or troughs in a laboratory, we know enough now of what may be done by chemo-organic re-agents upon the living blood in its own vessels,*

* Death by electricity, and the fluidity of all the blood which it instantly effects, though militating against consolidation, is perhaps a per contra argument for these speculations, as the reverse phenomenon of the separation and coagulation of the fibrinous portion of the blood in Asiatic cholera, from some similar electric influence, perhaps, is a *direct* argument.

to lead us to hope that the day is not distant when not only *aneurismal sacs* shall be *consolidated*, and the collateral sluices opened by some such processes, but when, on the other hand, we shall be placed in possession of far more potent and rapid discutients than are yet known, whereby *consolidated morbid growths* and tumors may be *dissolved*, and dispersed, and carried harmlessly out of the system, by absorption, into the general current of the circulation.

In support of what may be now denominated this, in our opinion, clearly-established process of *plastic or fibrinous consolidation of aneurismal sacs*, we would call to our aid the more recent researches on the subject of the composition and nature of *fibrinous* and other tumors, (which will be treated of in the beginning of and also throughout our last volume,) and also to what was so lucidly expounded by the practical though less chemico-analytical observers of other days, (by John Hunter, especially,) in their graphic, though brief descriptions, of that peculiar plastic process by which wounds heal by first intention, and which, while it is so like apparently to the natural process of *nutrition* or accretion of healthy organic matter, yet would seem different from it. This process, the nature of which has again come actively into discussion through the important uses to which it is made subservient in *sub-cutaneous and anaplastic surgery*, in the restitution and reparation of parts, &c., will be found ably treated of by our author, M. Velpeau, and others, in the animated debate which took place in the French academy, and of which we have given an extended abrégé in our first volume.

Professor Miller, of Edinburgh, has gone so far as to discard, upon such views, all the received notions on inflammation, and to consider it little more than *excessive nutritive action*. In curative processes, we know for a long time how happily this organic plastic power has been employed in the treatment of hydrocele, and from time immemorial, in the granulation and cicatrization of all purulent sacs, passages, &c. A new and most ingenious application of it both Dr. Mott and myself had an opportunity of witnessing in the *cure of formidable herniæ*, such, we mean, as were reducible, though large and of long standing. We have thus, in several instances, seen the contents of a large inguinal hernia first replaced in the abdomen, and then, through a careful sub-cutaneous puncture at a suitable distance from the external ring, a stimulating injection (of diluted tincture of cloves) thrown upon the outside of the sac, which, followed by a slight inflammation, redness, and tumefaction externally, without suppuration, has, after a few days in the recumbent posture, resulted in complete closure of the hernia by the agglutination of the outer walls of the tumor and of its neck, with those of the external ring—effecting thus a perfect cure of the disease. In fact, a proposition has recently been made to inject *tannin* into aneurismal sacs, to corrugate and contract their muscular fibres and to promote the consolidation of their blood.

We mention these facts, which might be largely augmented by what occurs in every day's experience, as illustrations of a great

organic law, which seems destined to be brought into requisition to fulfil a yet more important part than it hitherto has done as a great therapeutic agent.

b. "It has been objected," says Dr. Bellingham, "to this method of healing aneurism, that the *pulsation is likely to return*, in consequence of the artery not being obliterated at the point at which the pressure is applied, and that the patient, therefore, cannot be considered safe from a relapse for a considerable period." Dr. Bellingham deems the reverse to be true, and that pulsation is more likely to follow a ligature than pressure above (i. e., on the cardial side of the tumor) the artery; because the manner in which pressure brings about the cure of aneurism, appears to be nearly that by which *nature*, under the most favorable circumstances, effects a spontaneous cure. The fibrine of the blood is entangled by the lining membrane of the aneurismal sac, successive depositions occur until the sac is completely filled, the tumor becomes solid, and all pulsation ceases. The sac no longer permitting the passage of blood through it, the collateral branches become enlarged, and the circulation is carried on by them. The tumor then gradually diminishes in size, owing to the absorption of its contents and the gradual contraction of the sac, and finally it disappears. On the other hand, when a ligature is applied to an artery, as, for instance, to the femoral, for popliteal aneurism, the current of blood into the sac is at once interrupted; after a time, however, the blood finds its way into it by the collateral branches: now if an anastomosis of large vessels exists between the branches of the artery above the ligature and those between it and the aneurism, a strong current of blood will come to pass through the sac, and the pulsation will return; which cannot happen in the former case, for the reasons stated. The sac of the aneurism, likewise, after the application of the ligature, not being necessarily filled by solid fibrine, but by a coagulation which may be more or less loose, pulsation is more likely to return, as the sac must contract considerably before the patient can be considered safe from a relapse; and this, from the inelastic nature of the parietes of the sac, must require, sometimes, a long time to be accomplished.

Dr. Bellingham has admirably comprehended the superior efficacy of the process by which compression effects a cure, because, different from the violence of a ligature, it is a process entirely conformable to a great *normal organic law of nature* in the growth and reparation of parts.

c. This mode, by compression, it is asserted, is *more tedious and more painful* than that by ligature. That it is, says Dr. Bellingham, less tedious *sometimes*, several of the cases published clearly prove. In one of the last by compression published, the pulsation in the aneurism ceased in a few days after the application of the two instruments; in some of the others the cure was also rapid; and if in a few others, in which this mode of treatment was adopted, a larger time elapsed, it depended probably upon the imperfection of the instrument, the irritability of the patient, or upon

two compressors not having been employed together. With respect to the treatment of compression being more painful than the operation of placing a ligature on the vessel, *including the subsequent dressings*, until the ligature separates and the wound is healed, *this might have been* an argument against the method, when so great a degree of pressure was supposed to be necessary, as would obliterate the vessel at the part to which the instrument was applied; but the fact is, the application of the compressor (according to the rules laid down now) *really relieves the pain which the aneurismal swelling occasions*; after it has been applied, however, for a certain time, the pressure does cause pain, but the patient then *can relax it*, after having tightened the other instrument, and so continue to compress different parts of the vessel for any length of time.

The power or capacity of the living organization, to sustain for a greater or less period of time an incredible amount of pressure from external bodies, without being destructive of life or materially impairing the functions of the part compressed, has (Dr. Bellingham might have added) been long familiar to every one: as, for example, in the ancient usage of tight swaddling clothes to the new-born infant; the reprehensible and, until lately, universal practice of early and severe pressure by bandaging to the limbs, &c., in fractures, ordinary wounds, &c.; the instances where, in casualties by the crushing and falling of buildings, &c., masses of persons have, without injury or destruction of life, been wedged, jammed, or impacted together, for days even, in a manner which it was difficult to suppose could be for a moment reconcileable to, or compatible with, human existence; and, lastly, the remarkable changes which the form and dimensions of the organization itself may be made to assume from continued, severe, and apparently intolerable pressure, as to the cranium, as is related of the infants of Caribbean and other Indian tribes, and as to the feet among the Chinese, Spaniards, &c., &c. A more familiar, every-day example of the capacity of the external tissues and coverings to undergo severe pressure, prolonged to such extent as to cause almost entire absorption of the part pressed upon, is seen in the withering, atrophy, and absorption of certain muscular tissues, as the glutei muscles in shoemakers, actors, students; all the muscles of the ham in cavalry soldiers, postillions, carriers, &c., from their sedentary occupations or their position causing constant pressure on certain muscular and soft tissues, being the reverse of the extreme development which, on the contrary, certain muscles undergo, *à fortiori*, by constant use, as in the biceps, deltoid, pectoral, and other muscles of the arm in the blacksmith, forgesman, &c., the entire muscular masses of the thigh and leg, (especially the flexors of the thigh and leg, and the gastromenii and tendo Achillis,) in the dancing master, circus vaulter, pedestrian, &c.

The therapeutic value of pressure also has long been familiarly known in the cure of certain morbid growths, tumors, &c. By means of this mechanical resource alone, as is more particularly

illustrated in the perfect cure of old ulcerations and œdematous and varicose enlargements of the legs in intemperate persons, or those who are constantly standing on their feet, by means of the adhesive straps, &c. first introduced by Baynton; and the cure of many cases of lateral or other curvatures of the spine and limbs, by means of counteracting pressure (*redressement*) to the parts which have been deviated by the too great power of the antagonistic muscles. (Vid. Vol. I. of this work.) M. Velpeau shows its value as a means of radical cure in wounds of the brachial artery, in the operation of bleeding; and M. Amussat has also lately called special attention to it.

On the other hand it is a somewhat singular coincidence that pressure should be found to be a perfect cure for that kind of aneurism more especially (we mean the popliteal) which has itself been supposed to be most generally produced by excessive pressure to that artery in the ham, as in postillions, carriers, cavalry soldiers, and others accustomed to pass a great part of their lives on horseback. The formation of the aneurisms too in these cases goes to corroborate the views of Dr. Bellingham; for in such persons the column of blood in the arterial trunk or popliteal, is subject to frequent and *total* interruptions, not partial and incomplete.

d. It has been also urged, says Dr. Bellingham, that the period which has intervened since the re-introduction of this method of treating aneurism, is too short to allow us to conclude, that the cures will be permanent. I do not know the exact period of time which it is considered necessary should elapse, before a cure in such a case can be pronounced permanent; two of the cases of aneurism cured by compression in this city (Dublin) have remained well for upwards of two years, and two others for nearly the same period, and in none of the remaining cases has there been any tendency to, or appearance of a relapse. Now, supposing for argument sake, that the aneurism should return—the same thing has occurred after the application of the ligature; and if there should be a relapse, would not pressure then be as applicable as in the first instance? and would not its employment be much more certain and safe, than the application of the ligature a second time?

e. The last objection is from Mr. Syme of Edinburgh, who urges that the ligature is so easy, so perfectly safe, and gives so little suffering, that the laborious, distressing, and tedious procedure, by compression re-introduced by a Surgeon of Dublin, will he thinks, return to its original obscurity. Mr. Syme having tied the femoral artery *thirteen* times without meeting with the slightest unpleasant symptom—will not, he says, deviate from this line of practice. Several surgeons of Dublin however, says Dr. Bellingham, who have tied the femoral artery more than thirteen times, have thought proper to deviate from this line, and to adopt pressure.

Dr. Bellingham feels warranted in coming to the following conclusions:—

1st. That the arteries to which pressure is applicable, being far more frequently the subject of spontaneous aneurism, than those to

which it is inapplicable, compression promises to supersede the ligature in the great majority of cases.

2nd. Pressure has several obvious advantages over the ligature, being applicable to a considerable number of cases in which the ligature is contra-indicated, or inadmissible.

3rd. The treatment of aneurism by compression, does not involve the slightest risk; and even if it should fail, its employment not only does not preclude the subsequent operation by ligature, but renders the chances of the operation by ligature more favorable.

4th. That such an amount of pressure is never necessary as will cause inflammation and adhesion of the opposed surfaces of the vessel at the point compressed.

5th. Compression should not be carried so far as completely to intercept the circulation in the artery at the point compressed; the *consolidation of the aneurism* will be more certainly and more generally brought about, and with less inconvenience to the patient; by allowing a feeble current of blood to pass through the sac of the aneurism.

6th. Compression by means of two or more instruments, one of which is alternately retained, is much more effectual than by any single instrument.

7th. Compression, according to the rules laid down here, is neither very tedious nor very painful, and can be maintained in a great measure by the patient himself.

8th. An aneurism cured by compression of the artery above the tumor, according to this method, is much less likely to return than when the ligature had been employed.

Dr. Bellingham regrets to add that some of the objections to this new and hitherto successful mode of compression, by the Dublin Surgeons, have sprung as he considers from a discreditable feeling of jealous rivalry towards the Irish school, on the part of those of London and Edinburgh, a feeling which we cannot permit ourselves to believe could exist in any generous mind, when all should be alike emulous to surpass each other in the discovery or invention of improved or new modes of affording relief to suffering humanity; for that is, or should be, the common end and aim of all.

The two great principles then of this *cure of aneurism by compression*, as laid down by Dr. Bellingham, and which are undoubtedly the only rational grounds by which we can hope for success, resolve themselves into these:—

1. *Alternate Compression on different parts of the sound portion of the track of the Artery on the cardinal size of the tumor*, by means of the ingenious and simple compressors now used with such unvarying success by the Dublin surgeons.

2. *The diminution of the volume of blood in the affected trunk and not its total interruption*.—Of these two fundamental axioms, however, it must be borne in mind, that the latter which is of infinitely greater pathological importance of the two, and necessarily the result of the mechanical means of compression employed in the first, is not as might at first be inferred a new principle, but was well

known to those Surgeons who advocated and made trial of compression in the early part of the present century. Various instruments, after extensively detaching the femoral, were then tried, for pressing upon the vessel, *without impeding circulation through the limb*, and with success in cases of popliteal aneurism. (See Cornack's *London & Edinburgh Monthly Jour. of Med. Science*, Oct. 1844, p. 824, &c., and Boyer, *Traité de Malad. Chirurg.*, Vol. II., p. 234.* T.)

§ II.—*Direct Compression.*

It often happens, that surgeons find themselves so situated as to render it impossible for them to tie an artery which they have opened either by mistake or design; in such cases it is their usage, in order to save their patient from death, to plug up (tamponner) the wound, and compress the vessel by applying to it, directly, the different substances eulogized by Trew, Teichmeyer, &c. This method, besides being much less frequently employed than indirect compression, possesses in fact much fewer advantages, and ought, at the present day, to be wholly rejected: some success has nevertheless been imputed to it. (See observations of Dr. Mott, *supra et infra*. T.)

a. Plugging or tamponing, (tamponnement.)—Guattani, having to treat a very large inguinal aneurism, caused it to be opened by Maximini, with the intention of applying, immediately upon the artery at the bottom of the sac and against the pubis, graduated compresses, firmly secured by a spica to the groin. Everything succeeded to the satisfaction of the surgeon; the dressing was removed at the end of thirteen days, and the patient was perfectly restored.

A man had an aneurismal tumor on his groin as large as the head of a child. Mayer (*Rougemont, Bibliot. du Nord*, p. 189) took it at first for a hernia, and deciding to lay it bare in order to reduce it, did not discover his mistake until after having divided the common integuments and the aponeurosis. A great quantity of bloody matter, which had accumulated between the sac and the adjacent parts was now removed; in place of laying open the tumor, whose pulsations sufficiently indicated its character, Mayer confined himself to making methodical compression upon it, which he subsequently renewed with every possible care. The patient was cured.

Desault, in a case very similar, compressed, it is said, the upper end of the artery with two pieces of wood, united together in the

* See also the numerous authorities arranged by our author M. Velpeau, in the text immediately preceding this note, and wherein it will be perceived that *compression* above the artery, *i. e.*, on the cardinal side of the aneurismal tumor, was long since the subject of investigation, and obtained success even by the then crude modes of applying it. And it will also be seen that the very germs too of the great principles so successfully applied to practice by the Irish Surgeons, were years since anticipated in France and elsewhere, not only as to highly ingenious contrivances and to compression on several points of the vessel, but also as to the *master* principle of only partially interrupting the current of blood.

manner of a forceps, by means of a portion of thread, by which means he was enabled to dispense with the ligature. A young student of medicine, aged fifteen, saw the blood burst from the femoral artery while he was dressing a wound in the groin; his dressing forceps served him instead of Desault's pieces of wood; it was left undisturbed, and M. Champion assures me that the artery was rapidly becoming obliterated, when the patient was attacked with hospital gangrene, and died on the fourth day. But this procedure, excusable at the epoch at which it occurred, and in so young a student, would be censurable at the present time. If the aneurism is so high up as not to admit of our cutting down to, or compressing the femoral artery between the tumor and Poupart's ligament, we apply a ligature to the iliac artery, and avoid the danger which Guattani and Desault made their escape from, only as it were by a miracle. Sabatier himself, nevertheless, thought it advisable to undertake direct compression for an aneurism in the upper third of the thigh; the patient was a young man aged twenty-two years; two tourniquets were applied—one on the fold of the groin, and the other a little lower down. The tumor being opened and freed of its clots, the aperture of the artery was discovered, and found to be perfectly round. Sabatier passed under this vessel, above and below the opening, a needle armed with a strong thread, with the intention of completing the ligature, should that become necessary. A pad (*coussinet*) was placed on the posterior part of the thigh opposite the wound, which latter was filled up with a pyramid composed of pieces of agaric and compresses; lint well sprinkled with colophane was arranged around the pyramid, in such manner as to support it, and everything kept in place by compresses and an ordinary bandage; some slight hemorrhages supervened, but the patient ultimately recovered, and was enabled to walk at the expiration of two months.

Notwithstanding so many fortunate results, obtained by surgeons of the first rank, we ought nevertheless to reject this mode of treatment from sound practice. The only cases in which we would be permitted to make trial of it, would be those of false primitive aneurisms. At the farthest, it would be applicable only to arteries of the fourth order, or in those cases where, after having opened an aneurismal sac, it becomes impossible to find the artery—a difficulty which we can scarcely conceive possible, and which, moreover, could not become a source of embarrassment at the present time, except in cases where the disease was in too close proximity with the splanchnic cavities.

b. The Artery-presser, (presse-artère.)—Desirous of avoiding the vein, nerve, &c., and of concentrating as much pressure as possible upon the artery, many surgeons have substituted instruments in the form of a forceps, in lieu of the bandage and lint formerly in use. Percy, (*Soc. Med. d'Emulat.*, t. VIII, p. 689,) in order to fulfil this intention, recommended, in the year 1792, first a plate of lead; then, in 1810, a steel forceps, terminated by two small plates, and cleft in the direction of its length, in order that we

might be enabled, by means of a button, to graduate at pleasure the pressure upon the artery, (*Soc. Méd. d'Emulat.*, t. VIII, p. 711.)

In the same year, Duret, of Brest, (*Thèse, Paris*, 29 Aout, 1810,) made known an instrument constructed upon similar principles; that is to say, a forceps similar to the valet à patin, and which he denominates the *aneurismal forceps*. According to M. Roux, (*Med. Oper.*, t. I.,) an artery-presser, (*presse-artère*,) almost in every respect similar to this, had been devised, in 1808 or 1809, by M. Levesque, a description of which is given in his Thesis. (*Thèse No. 153, Paris*, 1812.)

A third kind of artery-presser, invented by Assalini and formed of two branches of silver united in the manner of a dressing-forceps, and having between their handles an elastic spring which constantly tends to shut them, bears much resemblance to that of Duret. Assalini affirms that he has cured aneurisms in the thigh and ham, by leaving his instrument in place for the space only of three or four days, and even after an interval of twenty-four hours. The artery-presser of M. Henry, (*Soc. Méd. d'Em.* t. VIII., pl. 6, fig. 7, 8 et 9,) shaped after the manner of the angular extremity of the shoemaker's podomètre, or that of the pelvimeter of Coutouly, has the advantage of being kept more securely in its place, and of giving less fatigue to the parts than those of Percy, Duret, and Assalini. (*Manuel de Chirurgie*, &c.) Forceps and other metallic instruments, which have also been proposed for effecting the same object, by combining them with ligatures, will claim our notice a little further on. Such are the artery-presser of Deschamps, Dubois, Crampton, Ayzer, Ristelhueber, and the one which M. Chiari (*Pl. Portal, Clin. Chirurg.*, t. I., p. 156) says he has made use of eight or ten times with success.

§ II.—Various Means.

A. *Cauterization*.—Cauterization has been applied in two modes, in the treatment of aneurism. Some, in fact, before the knowledge of the circulation of the blood, ventured to apply escharotics more or less powerful upon aneurismal tumors and the skin which covers them. Others commenced by opening and emptying the bloody sac; afterwards they cauterized the lacerated part of the artery, either with red-hot iron, or the concentrated acids, or by introducing into this orifice lozenge-shaped plugs (trochisques) and pegs (chevilles) of alum or vitriol. Then also, and even since, they confined themselves sometimes to filling the whole wound with lint or oakum, (*étoupe*,) impregnated with the same cauterizing substances. Such means were good when the nature of aneurisms was unknown, and when no one was possessed of anatomical knowledge sufficiently accurate to venture to use the bistoury; but at the present time they are named only to be proscribed, and to show how advanced modern surgery is from that of the ancients.

B. *The Suture*.—Towards the middle of the last century, Lam-

bert, (*Med. Obs. & Inquir.*, t. II.) an English surgeon, proposed to cure arterial wounds by means of the twisted suture. From the fact that, after phlebotomy, veterinary surgeons usually close the vein by a stitch with the needle, he thought that if this means, which Guy de Chauliac (*Traict.* 3, doct. 1, chap. III., p. 254) seems to have hinted at, were applied to man, it might be attended with the same advantages. Some trials confirmed him in his opinion; and his efforts, it is said, were crowned with complete success in the case of a man who had a traumatic aneurism in the arm, and whom he presented for examination before the members of a medical society at London. The great importance of the suture, however, according to Lambert, consists in its enabling us to preserve the calibre of the artery. But Asmann, (*De Aneurismate, Groningue*, 1773,) having proved that he was deceived on this point, and shown, as Galen has done, that the suture can effect a cure only by obliterating the vessel, his proposition, which has not been since revived, and which does not merit any further description, was soon forgotten.

C. *Torsion*.—Torsion having been examined as a hæmostatic means, (*Vid.* Vol. I.,) I have only to consider it here in its relations with aneurisms.

Torsion being found sufficient to arrest traumatic hemorrhage, whenever the gaping extremity of the bleeding vessel can be isolated and conveniently grasped, seems, according to the experiments of M. Thierry, (*De la Torsion des Artères*, Paris, 1829,) to be of a nature calculated also to effect the cure of aneurisms. After having publicly sustained this idea in a concours, M. Thierry made a certain number of experiments on the carotid of horses. His process consists in raising up the artery with the needle of Deschamps, which he afterwards makes use of as a garrot to twist it, always in the same direction, and a certain number of times, in proportion to its calibre; that is, four times for a small artery, six for a middle sized one, and eight to ten for the trunks of the largest volume. The experiments were invariably followed by the complete obliteration of the twisted vascular canal, so as to admit of immediate reunion, and leave nothing at the bottom of the wound. Nevertheless, I do not think that this method should be adopted. To perform it, it is necessary that the artery should be isolated to a very considerable extent, and the shortening which it is to undergo must have its influence on the ultimate success of the operation. It would appear to be almost impossible to avoid making traction upon the veins, nerves, and other surrounding parts, even in proceeding in the manner of M. Liéber, (*Annal. de Hecker*, 1830,) who has also occupied himself with this subject; moreover, it is not certain that the twisted vessel will not, in mortifying, constitute a foreign body more injurious than the simple ligature.

D. *Crushing*, (*écrasement*).—Others have thought, after Briot, (*Soc. Méd. d'Émulat.*, t. VIII., p. 276,) who had already spoken of crushing, that if, after having laid bare the artery, it was seized

with two forceps with flattened points, (*à mors applatis*), to twist it laterally, in order to crush (*broyer*) its internal and middle coats, and that if these ruptured, (*brisées*), tunics were then crowded up into the cellular coat, and the solution of continuity were immediately closed, it would enable us to arrive at the same result. M. Carron du Villards says he has made numerous experiments on this point with M. Maunoir, and that he has generally succeeded. "These experiments," says he, "were suggested to me in 1820, by Professor Maunoir, who, at this epoch, spoke to me of an instrument for crushing (*briser*) the internal coats of the arteries without recurring to the ligature. This instrument consists of a forceps much resembling that of M. Amussat for the torsion of the vessels, but it has no teeth, (*mors*), and its free extremity is formed by two catches, of the shape of barley grains, (*arêtes à grains d'orge*), which, encountering each other when they are pressed together, crush the artery and break its internal coats, without altering the external one." By means of this instrument of M. Maunoir, we can in general effect the obliteration of the arterial canal.

With this instrument, also, when used upon an artery of large calibre, and rupturing only a third of its canal, by making only two turns with the forceps, as if for the purpose of removing a flap (*losange*) from its tube, we may obtain almost always, in a short space of time, an aneurismal tumor. "I have shown," says M. Carron to M. Pacoud of Bourg, "a tumor created in this manner."

The experiments of M. Carron have since been repeated, by M. Amussat, with entire success; but, with this surgeon, the pushing up (*rebroussement*) of the ruptured (*brisées*) coats is the principal part of the operation, and that by which his process is characterized. It is to be apprehended, however, that we should deceive ourselves in relying upon this last-mentioned modification as an advantage. The membranes thus crowded back would sometimes, doubtless, shut up the artery; but, in addition to the objection that such a result would not always take place, I see in it, also, that of being obliged to lay bare the vessel completely, (largement,) and to isolate it all around and to a great extent from the veins and nerves, as in the process of M. Thierry; all which circumstances are calculated to thwart immediate reunion, and to render the operation longer, more painful, and less certain, than by the ligature, properly so called. This, therefore, is a method which must also be rejected.

E. Acupuncture.—While I was endeavoring, some years since, to disengage in a dog the femoral artery from its accompanying vein, and had separated it with a pin, some one came in and obliged me for a moment to suspend my operation. A movement of the animal caused the pin to penetrate through the artery, and become lost in the tissues of the limb; it still remained there on the fifth day. In examining the parts with care, I was enabled to satisfy myself that the obliteration of the vessel had been the result of this puncture. Such an effect was calculated to surprise me, and at

first appeared very extraordinary. Nevertheless, I soon explained it, in a manner that seemed to me satisfactory. Impressed with the idea that the contractions of the heart have less influence upon the movement of the blood than is generally supposed, I was soon enabled to comprehend *how a foreign body, even though very small, when placed at rest across a vascular canal, or making some projection (relief) in its interior, is capable of producing the same effect as a ligature.*

Thus, if an osseous or calcareous plate or lamella, free at one of its borders and adherent at the other, should be turned back and make a projection into the artery at the point where it had been developed, there is every reason to believe that it might become the nucleus, root, or source of a fibrinous concretion, capable of deadening (*amortir*) to a greater or less degree the impulsion of the blood, and of ultimately conducing to the obliteration of the vessel. The observations published by M. Turner, (*Transactions Medico-Chir. of Edinburgh*, vol. III., p. 105, 172, part I.,) those which M. Carswell has communicated to me, and some others of my own, place this fact beyond doubt. What I say of a bony plate, is evidently applicable to all kinds of projections, (*sailies*,) roughness, (*aspérités*,) or inequalities, to those which are the result, for example, of a laceration, or of a deposit of fibrine, plastic lymph, or any growth (*végétation*) whatever; in a word, to everything which in any way whatever diminishes the normal regularity of the tube through which the blood is obliged to flow.

Wishing to ascertain if it could be possible for me to procure at pleasure the result which I had obtained by chance in the experiment related above, I made some new essays. An acupuncture needle, about an inch and a half long, was, without any previous dissection, plunged into the thigh of a dog, over the course of the artery; I placed two others on the opposite side, in order to see the difference of effect which might result from them. In examining the parts, on the fourth day, I found my first needle transfixed through the outer third of the femoral, which, however, had not closed up, except to the extent of one half its calibre. Of the two others, one was found entirely outside the vessel, which latter was obliterated by a solid clot of blood of about an inch in length, pierced through its middle by the remaining needle.

I renewed these essays in the month of November, 1829, and afterwards in the month of February, 1830; and they have since been repeated by M. Nivert, then prosecutor (*preparateur*) for my course of operations, and now Doctor of Medicine at Azai-le-Rideau; I have subjected them to farther trials in the hospital of La Pitié, and their effect has been invariably the same.

In these last experiments, in order to be more certain of not passing outside the artery, I have always taken the precaution to lay it bare: sometimes I have made use of but one needle; at other times I have employed two, or even three, according as the vessel upon which I was operating was of greater or less size. As often as the foreign body has been enabled to keep itself in its

place at least for four days, a clot of blood has formed at the point punctured, and the obliteration of the vascular canal has resulted from it; the aorta, however, thus healed underwent no change, but as the needles did not remain in it but a little over twenty hours, I do not think it just to draw any conclusions from this experiment.

It is proper also to premise, that up to the present time my experiments have been made upon dogs of rather small size, and that the femoral artery is the largest vessel I have perforated. It is enough to say, that before drawing rigorous conclusions from them, they should be repeated and varied upon larger animals, for example, upon the horse. I ought also to add, that according to M. Gonzales, (*Thèse* No. 233, Paris, 1831,) my experiments, as repeated by M. Amussat, have not been attended with results as conclusive.

A single pin, or a single needle has appeared to me sufficient in arteries which do not exceed in size that of a writing quill; two or three would be necessary for vessels of one-half larger calibre, and nothing would prevent our employing four or even five for very large arteries. When we place in several it is proper to insert them at the distance of four to six lines from each other, and in a zig-zag direction, rather than upon the same line.

If such a thing could be relied upon, immense advantages would result from it. In the place of incurring the risk of wounding veins and nerves, and making that minute dissection, often so dangerous, which is required for the ligature, torsion and pushing up of the artery (refoulement,) it would be sufficient, in order to procure its obliteration, to lay bare one of the sides (faces) of the artery to the smallest extent possible, and without the necessity of displacing anything whatever. Perhaps by this means we might succeed in curing aneurisms of the most formidable character, among others those of the thigh and popliteal space, without dividing the skin; that is to say, by confining ourselves to piercing the femoral artery in the fold of the groin with a pin, needle, or any metallic substance whatever, or by perforating, with these foreign bodies, the aneurismal sac itself, in various directions.

An English Surgeon, M. B. Phillips, (*A Series of Experiments on Acupuncture, &c.*, London, 1832,) who was in Paris in 1830, and repeated my experiments in London in 1831, writes me, that proceeding upon these principles he had succeeded in curing an aneurismal tumor in the parotid region. We shall see further on the new methods which have been projected for these results for the treatment of varices and erectile tumors. I have, nevertheless, my fears that for aneurisms, properly so called, it will be with acupuncture as it has been with the seton, torsion, suture, and crushing, and that the ligature will for a long time to come be preferred to these different modes, in spite of the species of infatuation upon this subject which has taken possession of many practitioners otherwise respectable.

Very recently, and since the publication of my experiments

upon acupuncture of the vessels, it has been recommended, as it had also been by me, but with another object in view, to plunge a needle into the sac so as almost completely to transfix it, and to attach to this needle a metallic chain or rod by which electric shocks and galvanic currents could be transmitted through it. I know of no fact which exists in support of this proposition. All that I am aware of is, that M. Pravaz has endeavored to assimilate such a process to that of cauterization, and that it would not be too unreasonable to suppose, that by means of such experiments we might sometimes promote the coagulation of the blood in the tumor, and perhaps the cure of the aneurism. M. Liston, (*Gaz. Méd. de Paris*, 22 Septembre, 1838,) however, after having in vain tried it in a case of aneurism of the subclavian artery, felt himself obliged to abandon this means and proceed to the ligature of the vessel. [In noticing, in our first volume, the brilliant success which has attended the practice of Dr. Mott and others, in this country, by the insertion of red-hot needles through those forms of varicose aneurism, or erectile tumors, known as *nævi materni*, for the most part congenital, and therefore usually met with in children, it will be perceived that we had unintentionally omitted to do justice to our estimable author, M. Velpeau, to whom, as will be seen above, we are alone indebted, as we think, for the germ of this great improvement in Surgèry.]

§ III.—*The Ligature.*

If the obliteration of arteries is indispensable, or nearly so, in the cure of aneurisms, the ligature must be the surest mode of obtaining it; this is a truth which no one questions, and which never has been contested. But in order to apply a ligature upon an artery it becomes necessary to perform a serious (*sanglante*) operation; we are obliged to divide vital (*sensible*) tissues with a cutting instrument. Hence the attempts so often made to substitute for it some milder means.

A.—*Nature and Forms of the Ligature.* Nearly up to the present time threads of flax or hemp only had been employed; a single round thread was preferred to the small arteries; for the large trunks, however, several were united together with wax, in the form of a ribbon (*ruban*.) It appears, however, that the ancients had already used silk to tie the arteries. Guy De Chauliac (*Traict.* 3. doct. 1., chap. III, p. 255) asserts it positively of Avicenna, in cases of wounds accompanied with a flow of blood. Things were in this state when Scarpa and Jones proceeded to submit to the test of experiment and reasoning what had hitherto been adopted only by imitation.

I. *Scarpa*, the first of these authors, proved, that to obliterate an artery, it was necessary to place its walls into contact without lacerating them, and to promote adhesive inflammation. He, therefore recommends that we should make use of flat (plates) ligatures formed of six flaxen threads; and moreover, that we should place

between the ligature and the artery a small roll of linen (*rouleau de toile*) six lines long and three broad, which roll is spoken of also by Paré, Platner, and Heister, used also by almost all the Italian surgeons of the last century, by Funchall, and also by Forster, who substituted for it a small cylinder of wood, a quarter of an inch in breadth and three quarters of an inch long, a roll, which Saviard (*Observ. Chirurgic.*, p. 172) mentions as being in general employ in his time, but one which Le Dran did not approve of, and for which Cline afterwards substituted a piece of cork. By this means the internal and middle coats of the vessel are neither bruised (*froissés*) nor torn; their contact is perfect, and they unite solidly, and are blended together before even they can be cut through by the ligature which embraces them, and which with difficulty effects their ulceration. [Dr. Mott thinks that there cannot be a doubt that the *small round* ligatures, either of silk, flax, or hemp, (that of silk the best,) are preferable on all occasions; that the flat ought to be abolished; and that there should never be anything whatever interposed between the knot and the artery.]

II. *Jones*. According to Jones (*On the Use of the Ligature*, &c., 1806,) the opinion of Scarpa is wholly erroneous; it is not by inflammation upon the internal surface that arteries close, but by means of the effusion of coagulable and organizable matters which follows the rupture of their two inner coats; consequently, in place of flat or broad ligatures, and all kinds of rolls of linen, or cylinders, which to a greater or less extent impede this rupture, Jones recommends that we should make choice of threads which will do it in the neatest and best manner. Numerous experiments were made by him upon dogs and horses, and all have been attended with results conformable to his theory, which soon became a law with most English surgeons. According to M. Hodgson, (*On the Diseases of the Arteries*, &c., 1815,) the truth of this hypothesis is so evident that he cannot conceive how some persons still venture to use the broad (*larges*) ligatures, and little *rouleaux* of Scarpa. M. S. Cooper also, with some degree of bitterness, censures the French surgeons for having been so reluctant in adopting the practice recommended by Jones, a practice which has been carried so far as to induce some of his countrymen to make use of threads of an extreme degree of tenuity, those for example made of gummed silk, and used by dentists and fishermen, so fine, in a word, that in cutting them near the knot, after the manner of M. Lawrence, there remains in the wound the weight only of the twentieth, or even forty-sixth part of a grain. [This practice Dr. Mott has also tried, and the absurdity of it consists in this, that the wound will be healed by the first intention, and the ligatures by being left to remain as an extraneous substance, will, in the course of five or six weeks manifest their injurious action by producing suppuration. This practice is one that goes to the other extreme of Scarpa. T.]

III. Without calling into question the importance of the labors of Dr. Jones, M. Roux has persisted, and still persists, in using flat

(plates) ligatures, which he usually ties upon a small roll of adhesive plaster of diachylon, (*sur un petit rouleau de diachylon gommé.*) In support of his practice we may cite the names of Boyer, Scarpa, and M. Petrunti, (*Il filiatré Sebezio*, Aprile, 1836, p. 239,) and the authority also of the older writers since Saviard, in his *Observations on Surgery*, speaks of the little rouleau as a thing in common use. M. Crampton, in Ireland, has never employed any other method, and has had no reason to be dissatisfied with it; he has in fact opposed the doctrine of Jones with such force of reasoning as to prevent its being universally adopted in the three kingdoms.

M. Richerand supposed he could reconcile those different opinions by calling attention to the fact, that a flat (plate) ligature becomes rounded, (*s'arrondit*), in proportion as we tighten it, and that its final result is like that of the cylindrical ligature, to rupture the internal and middle coats of the artery; which argument would go to strengthen the mode adopted by the practitioners of Great Britain.

IV. *Jameson.* But next comes M. Jameson, (*Journal des Progrès*, t. VI., p. 117; t. VII., p. 126; t. IX., p. 150,) who, on the strength of new experiments, rejects the principal assertions of Jones as erroneous. It is not true, says he, that the rupture of the delicate (fragiles) coats of an artery is an advantage; on the contrary we should do everything in our power to prevent it. The fine threads and round ligatures are dangerous, both because they cut the internal and middle coats, and especially because they strangle the *vasa vasorum* of the cellular coat. M. Jameson nevertheless rejects every kind of foreign body recommended to be placed between the vessel and the ligature; also ligatures of thread, (*fil*) whatever may be their form or size. Strips of untanned deer skin appear to him to be infinitely preferable in all cases, inasmuch as these ribbons (*rubans*) have an elasticity and pliancy which allow of their gently closing, and bringing into contact (*plisser**) the sides of the artery, without rupturing anything, and without lacerating the *vasa vasorum*, and because also they may be left in the wound with impunity.

V. *Threads (fils) of animal matter.* Another question naturally connects itself with this discussion. It has been asked if it would not be possible to substitute for threads of vegetable substance, cords of animal matter, which are of a nature to soften (*ramollir*) and dissolve in such manner as to be carried away by interstitial absorption in the midst of the living tissues, without incommoding, in any manner, the reunion of the divided parts. A series of trials of this kind, with *silk*, were made at London in 1815; an experiment of M. Lawrence and another of M. Carwardine (*S. Cooper's Surgical Dictionary*, p. 131,) were attended with all the success that could be expected from them; the wound was cicatrized in the space of four, five, or six days, and the small knot left upon the artery was attended with no disadvantage; other experiments, however, have

* Literally *plait*, but fold expresses the idea better. T.

been less fortunate; either the immediate reunion did not take place, or there appeared at a later period, small purulent collections (foyers) and abscesses which did not dry up until after the expulsion or exit of the portions of silk that had been left in the tissues. In a patient operated upon the 29th of March, 1819, by M. Lawrence himself, the cure was not completed till the end of May. In a patient in whom M. Watson had tied the brachial artery by this method, he found the silken knot had lacerated the cicatrix, and that it did not come away until after the expiration of two months. The same result with M. Hodgson did not take place until the expiration of six months; the Neapolitan surgeons (*De Renzi*, trad. Ital. de ee livre, p. 81,) were not more fortunate; and M. Cumin cites a case of a patient who retained one of these ligatures in him for the space of two or three years. So that the result is, that silk has not been found susceptible of being destroyed by absorption.

M. A. Cooper succeeded perfectly by using a small cord (cordonnet) of cat-gut (boyau de chat;) this substance dissolves much better than silk, and would be preferable to it in every respect, if it were not necessary from its want of strength to use it of so large a size. In M. A. Cooper's first patient the cure was completed on the twentieth day; in another patient, who was eighty years of age, the wound took but four days to cicatrize, and in neither case did the ligature ever reappear. M. Norman (*On the Operation for Aneurism*, 1819) was not so fortunate. This physician made trial of the method of M. A. Cooper, on two occasions, and in both cases the cure was protracted to a long period. M. Wardrop, in some of his operations, conducted upon the plan of Brashdor, (*On Aneurism*, &c., 1828,) made use of the intestine of the silk-worm in lieu of thread. By employing silk called *morte pêche*, or raw (native) silk, immersed (mise) for twenty-four hours in saffron, in order to color it, M. Carron du Villards (*Lettre privée du mois d'Août*, 1837,) obtained the same results that M. Lawrence had in view.

According to M. Jameson and Dorsey, Physick, in the year 1814, was the first who made use of ligatures of animal matter; those that he prefers are round, and made of deer-skin or cat-gut; but like MM. Lawrence and A. Cooper, (Dorsey, *Elements of Surgery*, vol. II.) Physick's intention was to cut through or rupture the arterial coats, while M. Jameson positively advises that they should be saved.

The surgeon of Baltimore, gives to his deer-skin ligatures as much as two lines of breadth, and increases their resistance and strength, to a greater or less degree, by drawing them between the nails. Applied upon the artery, these strips (lanières) do not require to be drawn tight to efface its calibre; from whence it happens, that though there is no intermediate foreign body, they produce the same effect as the ligatures of Searpa, without arresting, like these last, the circulation in the vascular system of the cellular coat. M. Jameson asserts, that after having been drawn between

the nails, these ligatures may, when tightened with considerable force, partially divide the arterial coats, like the flat ligatures of thread or silk; while in their state of natural suppleness they are incapable of producing this effect.

VI. Observing that *lead, gold, silver* and *platina* but slightly irritate the parts with which they are placed in contact, Physick at first entertained the idea of constructing ligatures out of these metals. M. Levert (*Journal des Progrès*, t. XVII., p. 65) availed himself of the suggestion of Dr. Physick, and submitted it to a considerable number of experiments; he made five upon the carotid of a dog, with threads of lead drawn very tight, then cut very near the knot and left at the bottom of the wound. The reunion was effected at the expiration of the seventh, eighteenth, nineteenth, twenty-eighth, and forty-second day; the vessel was constantly found obliterated. The small circle of lead occupied a cellular cyst of greater or less density. Three experiments on the carotid, and two on the femoral, with gold threads; three other ligatures on the femoral, and the two carotids with silver threads; and three on the carotid with platina, produced the same effects as the threads of lead; finally, M. Levert obtained similar results, by making use of small cords (*cordonnets*) of waxed silk, gum elastic ligature, and even of fibres of grass, (*brins d'herbe*.)

VII. *Recapitulation.* The result of all these researches, as it appears to me is, that the nature and form of the ligature in the treatment of aneurisms, are not as important as has generally been supposed during the last thirty years, and that French surgeons have been right in not adopting precipitately, and without reflection, the conclusions deduced in England from the experiments of Jones. The massive ligatures of Scarpa irritate the wound too much, keep up too abundant a suppuration, and require too great a length of time before they can be extracted, to be deserving of any exclusive preference; this appears to me to be indisputable; but in flattening the artery, without folding (*plisser*) it: [i.e., without causing the inner tunics to fold upon themselves, as they do when cut through by a small round ligature of silk, &c. T.] they keep its walls in perfect contact, without necessarily dividing the *vasa vasorum*. In becoming inflamed under such pressure, the cellular coat soon transmits its organic action to the two other arterial tunics, and the whole is soon blended together in such manner as to form an impermeable cord.

The objections, therefore, that M. Hodgson makes to them, are far from being founded in truth. When we make use of a fine ligature, in order to be more sure of rupturing the internal and middle coats, we strangle at the same time, as M. Jameson maintains, the small vessels of the external coat; and it is not true as Jones contended, that the obliteration of the artery is mainly effected by an internal effusion of organizable lymph. The ligature itself is speedily surrounded with concretable (*concrescible*) matter; the continuity of the small ruptured vessels is soon re-established upon the outside of it, and the ligature ultimately finds itself in the

centre of an organic ring, (virole,) analogous to that which Duhamel had supposed in the formation of the callus of fractured bones. This albuminous virole, the formation of which in dogs, has been carefully investigated by M. Pecot, (*Thèse* No. 155, Paris, 1822,) becomes, after the extraction of the ligature, gradually harder, retracts upon itself, (revient sur elle-même) and little by little blends itself with the two obliterated ends of the artery. Scarpa, and MM. Crampton and Jameson then are wrong in imputing to fine ligatures a greater tendency to produce secondary hemorrhages, than to flat and broad ligatures.

As to ligatures of animal substances, there can be no question, that by permitting the wound to be immediately closed, they may be of great value in practice. The point to be ascertained is, what should be their form and precise nature. If you wish to have them very fine, silk only may be used; unfortunately, this substance, we have seen, does not yield to the interstitial action of the parts. The cat-gut has not the same solidity, and moreover is not very easily absorbed. The strips of deer-skin, endowed with a great elasticity, and readily dissolving, offer greater advantages; but before adopting them surgery requires new experiments; and also, that the results mentioned by M. Jameson should be confirmed by other practitioners. If we admit that these ligatures, when left around the artery do not act the part of foreign bodies, that they may be absorbed by the system, and are not necessarily obliged to be expelled from it at a period sooner or later, there is no person who cannot comprehend at a glance what advantages they would give to the patient. With them the plastic ring, (virole,) described by M. Pecot, would be rendered perfect, and protected from all perforation or interruption; supported by the exact approximation and immediate reunion of the parts, it would run no risk of being destroyed by suppuration, or torn by the removal of the thread. Moreover, whether this ligature should possess a little more or less breadth, whether the internal coats were or were not ruptured, or the *vasa vasorum* strangulated to a greater or less extent, the final result, in my opinion, would be nearly the same. Experience has now indisputably demonstrated that hemorrhage is neither more nor less frequent with flat than with round ligatures, with those of silk than with those of thread. The tenuity then and animal composition of ligatures would possess influence only in the eyes of those who would wish to sacrifice everything to the immediate union of the wound. But even though we should obtain this reunion, what advantage would it be in such a case? In admitting that there was no longer any wound, where is the surgeon who would venture to allow his patient to walk in ten or fifteen days after an operation for aneurism of the femoral artery? Since it so happens that even in those cases where we have recourse to secondary union, it is not the wound which retards the definitive cure; I cannot see, in conclusion, what particular utility there would be in reviving at present the discussion respecting the form and nature of ligatures.

B.—*The Permanent Ligature.* Every vegetable ligature, drawn sufficiently tight to intercept the passage of blood in an artery, is a foreign body which will not leave the wound until after having cut through the cord (cordon) which it embraces. In order, therefore, that its separation may not be followed by hemorrhage, it is necessary that the vessel shall have had time to close itself firmly above and below; otherwise the albuminous virole which surrounds it, possessing too little consistence to resist the force of the blood, and having, moreover, been already laid bare in the direction of the skin, will be speedily lacerated. If it [the ligature] were restricted, as is generally supposed, to producing adhesive inflammation in the strangulated portion of the vessel, there would be nothing to dread from its separation; for before the artery would allow itself to be cut through, it would be necessary that it should have become inflamed. But the experiments of M. Pecot tend to prove that this is not the case; the portion of the artery included in the noose of thread, according to this author, almost unavoidably mortifies, a little sooner or later, whatever may be the degree of constriction which it sustains, and it can only be by the steps of an eliminative process, analogous to that which in gangrene separates the dead from the living parts, that the ligature can be detached from the surrounding tissues.

When this process is not disturbed, when the organic elements, upon which it acts, continue to remain in the normal state, and nothing prevents them from contracting adhesive inflammation, the ligature is not eliminated until the fifteenth or twentieth day. As the upper end of the arterial canal is no longer permeable on the fourth or fifth day, we may, therefore, so far as this is concerned, rest perfectly easy. If, on the contrary, the walls of the vessel have unfortunately become softened and steatomatous, yellow and inflamed, the ligature will have soon divided them; if the artery shall not have become completely closed, its coats will ulcerate, and there will be no interruption to the course of the blood; finally, if these coats are indurated and encrusted with calcareous concretions, as so frequently happens in old men, we may understand why their inflammation will most usually be too feeble, and too irregular to admit of the effusion of those concretible matters required either externally or internally, and why the ligature, though it come away at a very late period, may give rise to a serious hemorrhage.

C.—*Precautionary Ligatures* (Ligatures d'attente.) To obviate these inconveniences it was proposed to use ligatures *d'attente*, that is to say, ligatures which are useful only when the first that have been applied have cut through the artery before its perfect obliteration; in a word, *Ligatures of Precaution*.

One of these ligatures was passed around the vessel without tightening it, at the distance of a few lines below the principal ligature. Another, composed of two threads, was placed a little

above the principal ligature ; the lower half of this ligature was to be tied in such manner as to strangulate the artery only to the degree required to deaden the force which the column of blood exercised upon the point we desired to obliterate ; a third, also double, was placed still higher, and this, in the same way as the upper half of the preceding, was left free. On the supposition that the fixed ligature had failed, force was immediately applied upon the first threads (*faisceau*) of the upper precautionary ligatures, and successively on all the others, in case of need, in such manner as to arrest the hemorrhage.

The same was done with the double thread of the lower ligature, which was intended only to oppose the reflux of blood from the wound. Such, for a long time were the arguments and the course adopted by A. Monro, Guattani, Hunter, Desault, Deschamps, Pelletan, and even Boyer. At the present time precautionary ligatures have almost entirely disappeared from practice. Far from being thought useful, they are on the contrary deemed exceedingly dangerous. At first they were censured, with reason, as irritating the wound too much, keeping up the suppuration, and forming an insuperable obstacle to immediate union. Moreover, Dupuytren and Bécларd have shown that the part of the vessel immediately adjacent to them, in proportion as it inflames, undergoes a fatty degeneration, (*lardacé*), exceedingly susceptible of being cut through, and altogether incapable of sustaining the action of any kind of ligature whatever ; from whence it happens that their application of itself is sufficient to bring about the ulceration of the artery, which they, in like manner, afterwards cut through with the same facility that they would through a slice of lard or cheese, as soon as we attempt to make the slightest degree of constriction upon them.

D.—*Temporary Ligature*. Not only have the precautionary ligatures been rejected, but it has even been proposed to ascertain if it would not be possible to remove, without endangering the success of the operation, the only ligature which had been employed, and before it should have had time to cut through the vessel. This is a two-sided question. Such practitioners as have occupied themselves with this subject have been influenced by two different and even opposite indications. According to some, the temporary ligature should rupture and obliterate the artery in the most prompt and perfect manner possible ; the others, on the contrary, proposed to close the artery by degrees, and not to rupture it by any special means designed for that purpose.

I. *Sudden (brusque) Obliteration*.—It is now more than thirty years since this question has been a subject of discussion in England. Jones asserted that he had ascertained that by rupturing at three or four different points, at certain distances from each other, the internal and middle coats of an artery, with that number of fine ligatures, an effusion of lymph would be effected, which would be sufficient to accomplish the desired obliteration, and to

allow of the ligatures being withdrawn in a few minutes. The results obtained by M. Hutchinson, (*Practical Observ. in Surgery*, p. 103,) fully confirm those of Jones. But MM. Dalrymple, Hodgson, and Travers have not been so fortunate: their experiments were made upon horses or sheep, and the artery was never, in any case, obliterated; they found it only in a slight degree contracted, (*rétrécie*) upon killing the animal at the end of thirteen, fifteen, or eighteen days. M. Travers, however, (*Observations upon the Lig. of Art., Trans. Medico-Chir., Vol. IX.,*) was of opinion that he might turn the suggestion to some advantage by modifying it. In the place of removing the ligature immediately after having strangulated the artery, he determined not to withdraw it until after the expiration of a period of time sufficiently protracted to allow of the clot and the effused lymph to acquire a certain degree of solidity, and a consistence capable of resisting the momentum of the blood. His experiments on horses led him to the conclusion that, *a ligature kept upon the carotid for the space of six, or two hours, or even for one hour only, generally effected a permanent obliteration of the artery.* In 1817 he applied the ligature upon the brachial artery of a man, and removed it in fifty hours, without the pulsations in the tumor having returned. M. Roberts (J. Bell, trad. d'Estor, p. 200, en note) went still further: a ligature which he left only twenty hours on the femoral artery of a sailor, who had an aneurism in the ham, effected a perfect cure in the space of twelve days.

In repeating these experiments the same success, unfortunately, has not always attended them. M. Hutchinson has seen the circulation immediately re-establish itself in the femoral artery, though it had been strongly constricted by a ligature for six hours. The same thing happened to M. A. Cooper, (*S. Cooper Dictionary, &c.,* p. 123,) after thirty-two and forty hours. M. Travers himself, after removing a ligature which had been applied to the artery of the thigh for twenty-five hours, noticed that the pulsations gradually returned in the aneurism, that they would not yield to indirect compression continued for a long time, but required the application of a ligature in the ordinary mode; so that he ultimately abandoned this practice, which the experiments of Bécclard have prevented from being adopted in France.

At the moment when the temporary ligature was losing its warmest partisans in London, it was seized upon by the surgeons of Italy. Scarpa (*Bull. de Férussac, XXI.,* p. 115. *Arch. Gén. de Méd.,* t. II., p. 82) made new experiments with it, and exerted himself to procure its adoption. Flat ligatures, tied upon a small cylinder of linen, besmeared with cerate, and placed around the carotid of a number of sheep, and withdrawn on the third, fourth, or fifth day, always effected the solid obliteration of the vessels. Repeated on horses, by M. Mislei, a veterinary surgeon, at the school of Milan, these experiments were followed by results precisely similar. The experiments were not less fortunate when

used on a man. Paletta, communicated two remarkable cases of this kind to Scarpa, (*Arch. Gén. de Méd.*, t. II., p. 82 à 101.) The first was a man forty years of age, who had had an aneurism in the ham for two or three months; the ligature was applied upon the artery on the 8th of January, 1817, and removed on the 12th. The second was a patient sixty years of age, and who had an aneurism at the bend of the arm. A ligature placed upon the brachial artery was removed on the fourth day; and, as in the first patient, this operation also had a fortunate termination. A popliteal aneurism treated in the same manner by M. Morigi, (*Valentin, Voyage en Italie*, 1826,) terminated equally well. The same result took place in a fourth patient whose brachial artery had been wounded, and who applied for relief to the hospital at Padua. MM. Molina, Fenini, Maunoir, Graefe, (J. Bell, trad. d'Estor, p. 200,) Dolcini, (*Bulletin de Férussac*, t. II., p. 334,) Medoro, Solera, Falcieri, (*Ibid.*, t. XIX., p. 277,) Uccelli, Giutini, Malago and Balestra, (*Ibid.*, t. II., p. 334,) have also used the temporary ligature with success for aneurisms of the carotid artery, femoral, &c. Vacca, (*Reflections sur la Ligat. Tempor.*, &c., 1823,) however, soon raised the objection, that after having removed the ligature, the artery, nevertheless, a little time after, was sooner or later divided, and the experiments of M. Pecot, contrary to those of M. Seiler, tend to confirm this opinion, which however does not in any respect detract from the value of the facts and reasonings adduced by Scarpa.

The difficulty in these cases, as is proved by a fact related by Morigi, (Pl. Tortal, *Clinica Chirurg.*, t. I., p. 162,) consists in removing the ligature without making traction upon the artery and disuniting the lips of the wound. All the modes resorted to in England for this purpose are objectionable. The two single threads which Paletta and Roberts previously place between the vessel, or the small cylinder, and the thread which serves as the ligature, in order to untie this last in drawing the others towards us, effect the object proposed but very imperfectly. The same may be said of the piece of grooved sound which M. Uccelli at first includes in the same ligature with the cylinder of linen, and upon which he proposes, at a later period, to divide the ligature. M. Giutini, in order to extract the foreign body fixed upon the artery, and to facilitate the section of the ligature, makes use only of a waxed thread, which he attaches to the extremity of the small cylinder before adjusting it.

For all these modes Scarpa substitutes the following: a grooved sound, cleft at its extremity, and having two small flattened rings upon one of its lips, one at half a line from the point, the other at near an inch from the plate, (plaque,) serves to guide a very small knife to the thread of the ligature which embraces the artery. The manner of proceeding with this small apparatus is perfectly simple. The end of the ligature, which has been left outside, is first passed successively through the two rings which are designed to receive it; and the beak of the sound is then securely guided

to the small cushion of linen which arrests its progress, (*Archiv. Gén. de Méd.*, t. II., p. 245.) Then the small knife penetrates without difficulty down to the ligature, which it divides transversely, and which may then be withdrawn, says the author, without exposing the artery to the slightest risk.

II. *Gradual Obliteration*.—Some trials have also been made with the temporary ligature, by combining it with direct compression. From the fear of suddenly interrupting the circulation in the limb, and the dread of hemorrhage after the ordinary ligature, many French surgeons, between the years 1790 and 1815, proposed that the constriction of the artery should only be accomplished by degrees. The instruments made use of to effect this object, by allowing us to augment or diminish the constriction of the vessel at pleasure, and to remove or replace them whenever we should desire to do so, may be united very advantageously with the process of a sudden obliteration.

a. *Process of Deschamps*.—In 1793, before the temporary ligature was thought of in England, and consequently, before it was employed in Italy, Deschamps (*Mém. de la Soc. d'Emul.*, t. VIII., p. 689) proposed his *artery-compressor*, (*presse-artère*) that is, an instrument composed of a flattened metallic stem, (*tige*), about three inches long, cleft at its free extremity, and terminated at the other end by a horizontal plate resembling the flat head of a nail, whose length exceeded its breadth, and was pierced with two long openings near its edges. He first inserted into and conducted through the two openings of the instrument, the two halves of the ligature passed under the artery; then, on drawing upon the one he caused the other to descend; by which means the vascular trunk was flattened between the portion of the ligature which compressed it from behind forwards, and the plate of the artery-compressor, the action of which was to press against the artery from before backwards. The operation was finished by fastening the extremities of the ligature upon the cleft of the instrument.

b. The little *rundlet*, (*barillet*) of Assalini, (*Bullet. de Férussac*, t. II., p. 84,) the compressors employed or recommended by Flajani, Buzani, Garnery, Ayzer, (*Dissert. etc., Gotting.*, 1818. *Soc. d'Emulat.*, t. VIII., p. 692,) and MM. Crampton, (*Medico-Chirurgical Trans.*, vol. VII., 2d part, p. 341,) Ristelhueber, (*Mém. de la Soc. d'Emulat.*, t. VIII., p. 685, pl. 7, fig. 9, 10,) Deaze, Jacobson, (*Bull. de Férussac*, t. II., p. 84,) and Chiari, (*Pl. Portal, Clin. Chirurg.*, t. p. 154,) though differing in some respects from that of Deschamps, or from the forceps of Schmucker, (*Bullet. de Férussac*, t. II., p. 84,) have, nevertheless, all been constructed upon the same principle, that is to say, with the intention of flattening in place of strangulating the vessels, and of withdrawing the ligature or the compression, at the expiration of a determined period of time. Like that, also, they all have the inconvenience of greatly irritating the wound, of favoring the ulceration of the artery, and most generally of effecting only an incomplete closure of the vessel.

c. *New Process*.—If it were allowable to deduce conclusions from some experiments made upon dogs, the following process would be as easy as it would be certain to effect the obliteration of the vessels by means of temporary ligatures. We insert under the artery a simple pin, whose two extremities are then to be embraced by a noose of thread, as in the twisted suture, which is to be tightened sufficiently to arrest the current of the blood. A second thread, attached to the head of the pin, allows of our extracting it when we judge it suitable to do so. The ligature being thus left free, offers no farther resistance, and falls out as it were of itself. This process, which will be treated of more fully under the article *Varixes*, (varices,) and which, in certain cases, would enable us to dispense altogether with an external wound, is of such easy application, and succeeds so well upon veins, that we cannot see why it should not procure the same result for arteries. The experiments undertaken by M. Franc (*Journal des Connoiss. Med.-Chir.*, 1835, t. III., p. 15, ou, *Thèse*, Montpellier, 28 Mars, 1835,) fully sustain, moreover, what I had written upon this subject in 1831. The process used by M. Malago, (*Bullet. de Férussac*, t. XVIII., p. 82,) and which consists in twisting the two heads of the ligature without tying them, would in truth be still more simple, but it does not offer the same degree of certainty.

d. *Process of Dubois*.—The idea which Deschamps had in using his artery-compressor, of obliterating the vessel only by degrees, was adopted by Dubois, (*Soc. Med. d'Emulat.*, t. VIII., p. 706, pl. 7, fig. 5, 6,) who, in 1810, proposed to found upon this method a new process for treating aneurisms. After having placed the ligature of thread (ruban de fil) around the artery, this practitioner passed its two extremities into the knot-tightener (*serre-nœud*) of Desault, (*Bullet. de la Faculté*, 6e année, p. 40,) in such manner as not to intercept the course of the blood except by degrees, and not to effect an entire obliteration until after a period of six or eight days. His object in acting thus was to permit the collateral vessels (canaux) to dilate themselves gradually, and to prevent the gangrene which was produced at this epoch, also by the sudden strangulation of a large artery. The two fortunate results which were obtained by this process at the clinique of the faculty, at first strongly attracted public attention, but the third attempt having been followed on the fifteenth day by hemorrhage, which rendered amputation necessary, and caused the death of the patient, though the pulsations had ceased to be perceptible in the tumor from the tenth day, soon put an end to such flattering hopes. Since then I was not aware that any one had again attempted this process, notwithstanding the two fortunate results that MM. Viricel and Larrey (*Clin. Chir.*, t. III., p. 246,) say they have obtained from it. Now that we know in what light to consider the dangers of suddenly suspending the circulation in the principal artery of a limb, a process like this has necessarily fallen into disrepute; and what I have said of precautionary ligatures, shows sufficiently that it would be one of the most dangerous that could be proposed.

e. The *gradual closing* therefore of arteries, ought to be rejected from practice, unless it could be effected by one of the modes of indirect compression, as for example, by one of the processes of MM. Viricel, Leroy, or Malgaigne, already related. As to the temporary ligature, properly so called, I am of opinion that it ought still to be made trial of. Could the artery be thus disembarassed in four or five days, of every kind of extraneous substance, it would run no risk of becoming altered or divided; the hemorrhage and purulent collections would by this means become less frequent, and the success of the operation would, in every respect be rendered more certain.

E.—*The Double Ligature with the section of the artery between.* Celsus, (*De re Méd.*, trad. de Ninnin, t. II., p. 17,) Galen, (Lib. v. *Therapeut.*, cap. III.,) Aetius, (*Tet.* 4., Serm. 3, cap. X.,) Guy de Chauliac, (*Grande Chirurgie*, trad. de Joubert, p. 173,) Rufus, Rhazes, Gouey, Severin, (*Méd. Efficace*, bibl. de Bouet, p. 98,) and Purman, (Thierry, *Thèse* 1750, *Choix de Haller*, trad. Franç., t. IV., p. 15,) were in the habit of applying two ligatures at a certain distance apart, and of then dividing the artery transversely between them. Pelletan (*Clin. Chirurg.*, t. I., p. 192,) following the advice of Tenon, was upon the point of adopting this process, which was entirely forgotten towards the end of the last century, and strongly censured by Heister, Callisen, and Richter. Abernethy (Dorsey, *Elements of Surgery*, vol. I., p. 213,) however adopted this method in his first operations of ligatures upon the external iliac artery, without being aware that his countryman, Bell, (*Traité des Plaies*, trad. Franç., p. 102, 115, 117, 122,) had mentioned it, and considered himself the author of it. With this precaution, says he, the two ends of the artery retract towards the tissues, suffer no traction, and are placed in the same condition as after amputation. M. Maunoir, (*Thèse* No. 328, Paris, An XIII.,) in a memoir on this modification, which he also regarded as belonging unto him, declared himself its unqualified champion. Like Morand he accords to the arteries a great retractile power, considers that the circular ligature, by puckering (en les fronçant) them, shortens their length, and exposes them to violent traction by the impulsion of the heart at each throb of the pulse; and that the best means of preventing secondary hemorrhages, must be to allow the artery which we have just tied, to withdraw itself into the soft parts, to an extent proportionate to its natural retractility (retractilité.) Some facts related by Abernethy, and Blacke, and MM. A. Cooper, Maunoir, Dalrymple, Post, Guthrie, &c., seemed at first to give a favorable reception to this method, which MM. Roux, Larrey, and Taxil, in France, were not opposed to adopting, at least for the large arteries. Having been made trial of, however, in 1807, by M. Norman, of Bath, it gave rise to an alarming hemorrhage, and Scarpa, who rejects it, arrays against it the cases of Monteggia, Assalini, &c., in which it was followed by hemorrhage of a fatal character.

The truth is, that the reasons which have been advanced for

dividing the artery between the two ligatures are poorly sustained. The retractility imagined by Morand and M. Maunoir, and which has been so much insisted upon since by Bonfils, (*Thèse de Strasbourg*,) and Taxil, (*Journal Universel des Sciences Médicales*, 1816,) and more recently still by M. Guthrie, (*Diseases of Arteries*, London, 1830,) can scarcely be said to exist, as has been proved by the experiments of Béclard, (*Soc. Méd. d'Emulat.*, t. VIII., p. 569,) the truth of which I myself have had very frequent opportunities of attesting. If, after amputation of the limbs, the arteries sometimes recede to a great distance, it is because they are drawn up by the muscles, and not in consequence of a retraction which properly belongs to them. Moreover, supposing that when strangulated in a ligature, they undergo a certain degree of traction, nothing is more easy than to put a stop to this without affecting the continuity of any tissue. To effect this object we have only to adopt the recommendation of Lyng, (*Ib.*, p. 719,) namely, to put the limb in semi-flexion, and all the muscles in a state of relaxation. This section is not only unattended with any decided advantages, but may incur the risk of most serious consequences. Suppose, for example, the ligature upon the upper end of the artery should happen to slip off and become loose, as happened to MM. A. Cooper and Cline, (Dorsey, *Elements of Surgery*, vol. II., p. 214,) there would necessarily result from it an alarming hemorrhage, which might speedily prove fatal, if the patient was not instantly relieved. Let a similar accident take place after a ligature upon the carotid artery at the lower part of the neck, or of the subclavian, or either iliac, and death will almost inevitably be the result. We must therefore come to the conclusion, that the advice given by Abernethy and M. Maunoir, to apply two ligatures, and to divide the vessel in the intervening space, is a method dangerous in its consequences, and insufficient for the end proposed, even though we should place, as M. Petrunti (Pl. Portal. *Clin. Chirurg.*, t. I. p. 168,) recommends, the little rouleau of Scarpa under each thread.

F.—*Ligature through the Artery.* For sometime past attention has been drawn to a process, already mentioned by Dionis, and which Richter describes in these terms: "The artery being drawn outward, an ordinary ligature, should be passed round it twice; this should be made tight by a knot, and when the artery is of considerable size, one of the ends of the ligature should be passed through it by means of a needle." This is the plan which Cline thought it proper to recommend, in order to prevent the ligatures in the process of M. Maunoir from becoming loose and escaping from the ends of the artery. M. A. Cooper made trial of it for aneurism in the popliteal space, in a man aged twenty-nine years. The two ligatures were first made tight (*serrées*) at the bottom of the inguinal space, then the needles were passed between them, through the coats of the vessel; the ends of each of the threads were afterwards fastened on the knots of the first ligatures, with the view of opposing an impediment to their slipping. M. S.

Cooper, (*Dictionary of Surgery*, Art. *Aneurism*, p. 129,) and all other surgeons, very properly as I think, censured this process, which has neither analogy nor experience in its support, and the employment of which has nothing to justify it.

Nevertheless, it might very naturally have suggested the one which M. Jameson appears to have frequently made trial of with success upon animals. This physician thought that all that was necessary to obliterate a large artery, or a large vein, was to pass a seton through it of two or three lines in width. Experiments made by him upon the carotid and jugular of horses, with ligatures of deer-skin, have always caused an effusion of plastic lymph in the interior of the vessel, a thickening of the perforated tunics, and soon after a complete interruption to the current of blood. I learn from M. Chaumet, of Bordeaux, that these experiments were repeated at the Val-de-Grâce, and followed by similar results. M. Carron du Villards, has also made a series of experiments on animals, which demonstrate that the same effect may be produced by piercing the artery with a linen thread, or with iron, steel or silver wire, &c.; this, therefore, is a new question which, without being a matter of any great importance, nevertheless, in my opinion merits the attention of practitioners. A ligature of deer-skin, or a conical piece of the same substance, passed through an artery, and then left at the bottom of the wound, would in no respect interfere with immediate reunion, and would render the operation for aneurism exceedingly simple, if the cure would as certainly follow as after the ligature.

G.—*Indirect Ligature.* The ancients, deficient in the required anatomical knowledge, did not take the trouble to lay bare the artery, and confined themselves in some cases to inserting the ligature through the whole thickness of the limb, between the vessel and the bones, tying the ends afterwards upon a compress placed between the ligature and the skin. This is what Thévenin recommended, and what both Le Dran and Garengéot did not think discreditable to adopt even at the commencement of the last century, in order to suspend the circulation in the brachial artery while they were disarticulating the shoulder. Though aneurisms may have sometimes been cured by this method, there does not seem to be any necessity for my discussing the subject to any greater length at the present time, in order to demonstrate its inconveniences and dangers if it should be applied to the deep-seated or large-sized arteries. The superficial arteries, and those of the fourth or fifth order, are the only ones, in fact, to which it could be at all applicable. In the fingers, wrist, face, and cranium, a pin passed under the artery, then surrounded by a thread crossed in figure of 8, or made tight in circular turns under its extremities, would probably succeed as well as the direct ligature. The thread passed with a curved needle, under the artery, and then tied into a knot upon a small compress, (*coussin*.) would answer the same purpose. The operation would thus be rendered more simple, easy and prompt, and less painful.

H.—*The Direct (Immédiate) Ligature.* When it was the practice to search for the artery at the bottom of the aneurismal sac, it was sometimes so difficult to isolate it from the surrounding tissues, that the question was asked whether it might not be allowable to include at the same time, in the thread, both the vein and the nerves. Molinelli (*Mém. de l'Institut. de Bologne, Clin. Chirurg. de Pelletan*, t. I., p. 143,) maintains that it is useless to observe so much precaution, and that the strangulation of the large nervous cords rarely endangers the success of the operation. This was also the opinion of Thibault, (*Dionis*, edit. de la Faye, p. 703,) Surgeon of the Hotel Dieu. Thierry (*Thèse de Haller*, trad. Franç., t. IV., p. 16,) arrived at the same conclusions, after having made a number of experiments on dogs, sometimes by tying the axillary and femoral arteries, without touching the nervous plexus; and sometimes by including this plexus in the ligature, in none of which cases did gangrene or permanent paralysis take place. The moderns nevertheless have rejected his views on this matter, and think unless there should be insurmountable difficulties in the way, that the artery alone should be embraced by the ligature. Though even the case quoted by Pelletan, (*Clin. Chirurg.*, t. I., p. 143,) from a letter of Testa's, in which it is seen that a patient operated upon by Falconnet, who had included in the same ligature the popliteal nerves, vein, and artery, was seized with frightful pains in the limb, which became gangrenous the very evening of the day of the operation, might not make it imperative to conform to the practice of surgeons in our time, reason alone would have sufficed to persuade us to do so. That the section, in fact, of one, or of several of the nerves, does not necessarily cause paralysis, may be conceived; that a ligature upon a large vein should not be constantly followed by gangrene, we may also understand, whatever M. Guthrie may say on this matter; (*Diseases of the Arteries*, &c., p. 128,) but let those two kinds of organs be strangulated at one and the same time, with the principal artery in the same limb, and it is undeniable that mortification and loss of sensibility will take place, if not always, at least in the greater number of cases. In recommending that we should pay no attention to parts so important, have not surgeons wished to justify the little trouble they took to isolate the artery, and thereby to depreciate the advantages of an opposite course? At the present time therefore it is the rule not to allow either the vein, or the smallest nervous filament, or any of the surrounding tissue, to be included in the ligature with the artery; and this, without doubt, is one of the reasons why the operation for aneurism, once so formidable, is now so simple and easy. M. Ghidella, (*Bullet. de Férussac*, t. XXIV., p. 172,) who, in adopting the advice of Monteggia, included the nerve and the vein in the same ligature, in tying the femoral artery for a hemorrhage, following amputation of the leg, will not succeed in causing this practice to be revived, notwithstanding the success he boasts of. M. Grillo also, (*Gaz. Méd. de Paris*, 1834, p. 539,) who asserts

that he cured *fifteen* patients by tying the femoral artery in this manner, places himself beyond the pale of my comprehension.

I.—*The Double Ligature.* Since precautionary ligatures have been rejected, some persons have thought that for greater security, it would be well to apply on the large arteries two ligatures, at a certain distance from each other. Vacca says, that by proceeding in this manner we gain nothing, since the intermediate portion of the vessel between the two ligatures, necessarily becomes gangrenous. But this reasoning of the Professor of Pisa is not valid; for M. Briquet states, according to B  elard, that a segment of artery continues to retain its vitality, though it may no longer have any connection with the trunk from which it is separated; it is therefore for other reasons that it has been thought advisable to prescribe the double ligature.

[*Ligatures, Compression, Torsion on Arteries, &c.*]

The revival, by the Irish surgeons, of the ancient pathology by which the consolidation of aneurisms was supposed to be most promoted by diminishing only, and not entirely arresting, the current of blood, gives great additional interest at the present time to every new investigation on the subject of the application of compression, ligatures, torsion, &c. It would seem, in fact, by the experiments of M. Manec, that whichever be the true doctrine, i. e., whether the inner lining of arteries has absorbents, and can absorb, or so change the clot above the ligature as to prepare it to become organized by fibrinous lymph shooting through it from the coat in question, or whether the clot be an impediment or not to agglutination of the parietes of the artery, which common observation on the healing of wounds would seem to authorize us to believe, as is remarked by Mr. Spence, (*Cormack's Lond. and Ed. Month. Jour.*, &c., June 1843, p. 500, &c.,) it is certain the natural adhesive process for the union of the sides of the artery is often destroyed by the suppuration required to enable the ligature to cut through it. At the first view, therefore, it would seem to be the most reasonable course to adopt the most natural method, as that of *qualified compression*, as used in the Dublin mode of curing aneurisms; and that this is preferable to torsion, and torsion to ligatures. The base also of the secondary coagulum, and which collects or elots above the ligature, would also, M. Manec says, be destroyed by the same suppuration, and thereby give rise to immediate hemorrhage, if its usual length, and the partial agglutination of the coats which has taken place below did not together have power to resist the impulsion of the blood. (*Ib.*, ioe. cit., p. 502.) From whence is deduced a rule where ligatures are used, not to apply them, if possible, too near a collateral branch; or, if that cannot be avoided, not to isolate the trunk too much.

According to M. Manec, the clot from the sixth to the tenth day, is found to be composed of a homogeneous coagulum and a coagulable lymph, uniting said mass to the vessel, by means of a clearly

discernible *filamentous* connexion which shortly becomes *areolar*. All this gradual change of coagulated blood into lamellated tissue, and which organization extends through successive layers of the entire substance of the coagulum, before reaching the centre of which *red striæ* appear in it in those parts nearest to the artery, are ascribed by M. Manec (*loc. cit.*) to the impulsion of the blood. The red striæ, according to him, seem to be absorbent vessels which slowly take away the colorific principle of the blood and return it to the circulation. The striæ, then, after doing this duty, lose their color and consolidate, forming the basis of the fibrinous web, into which the sanguineous coagulum is always changed; each fibrous filament thus appearing to be formed of an obliterated vessel. The whole of this very plausible explanation, should it turn out to be true, goes still further in favor of qualified compression, rather than of ligatures or torsion.

M. Spence (*Ib.*) differs from Manec in respect to the clot being absolutely necessary, as he says lymph, as he has proved, will be poured out and unite the arteries firmly without the coagulum. Thus, in the two carotids in the same dog, one had not, and the other had, the coagulum, yet both were perfectly obliterated. The great Hunter's success in injecting coagula; and the recent investigation of Dalrymple (*Lond. Med.-Chir. Soc.*, vol. XXIII.) favor Manec's views. MM. Jones, Travers, Guthrie, and others, think reunion depends entirely on the cicatrization of the divided tunics, and that the clot is incidental, and may assist, but is not essential. This is the most common opinion, according to Mr. Spence, who does not, as we perceive, coincide with it, but almost entirely with that of Manec. All of these investigations, however, he says, overlook a very uniform and important process, and which is, the *changes which take place on the exterior of the vessel*, but slightly mentioned by Jones and others, but never as conducing to the obliteration of the vessel. Thus, in examining an artery, forty-eight hours after being tied, (*loc. cit.*, p. 504,) we find it, he says, surrounded for a considerable distance above and below the ligature, by a deposition of pretty firm lymph, which presses upon and adheres to the coats of the vessel, completely imbedding the ligature, which is deeply sunk between the ends of the artery. The adhesions of the lymph to the arterial parietes at this time, though distinct, are slight. Ninety-six hours, after ligature, the effused lymph, though diminished in bulk, has become much firmer, and is, as it were, concentrated round the vessel; and when the external portion is dissected off, we see distinct filamentous bands passing from one end of the vessel to the other, around its entire circumference. At the ninth day after the operation, that is, when the ligature is separating, we find that the thread is enveloped in a tubular sheath of lymph, that the deposit round the vessel itself is now very dense and firm, and if the ligature be partially separated, we find that the effusion of lymph has kept pace with its separation, and united the ends of the vessel at the point whence the ligature has separated, immediately behind the thread. On the thirteenth day, that is, when the ligature

has fairly come away, (these were the dates in Mr. Spence's experiments, the illustrations of which are seen in his series of preparations, in the Anatomical Museum of the University of Edinburgh) the lymph has assumed the appearance of a firm connecting medium, uniting the divided ends of the vessel, *not unlike* the exuberant *callus* in a fracture; at the twenty-eighth day in some, but later in other cases, it has become much absorbed, so that the vessel has now the appearance of a firm impervious cord, at that part where the effused lymph formerly existed. (Ib., p. 504, 505.)

It is impossible not to be struck with the analogy of the organic process here described, with that already explained and incontestably established in the remarks of our author, (vol. I. of this work above,) on what takes place after the division of tendons. There can be no doubt that nature, so fond of uniformity and harmony in all her works, does, in the obliteration of arterial tubes, so far as their external surface above and below the ligature is concerned, act in the way described by M. Spence: and it forms in our mind another argument in favor of QUALIFIED COMPRESSION, which must by its nature be better calculated to bring about to a greater extent, and more equably and gradually this agglutinating organic process, external to the tunics, than a cutting ligature, whose interference is admitted, (see above,) possibly can be. The importance of this process, interfered with, as it certainly is by the ligature, in all that part occupied by the constriction, is shown in the two simultaneous actions going on in the ligature, viz., ulcerating its way outwards, and followed up behind it by the reparative process of the effusion of lymph keeping pace with the ulceration, as was long since seen, says Mr. Spence, in the old operation for fistula, with the gradually tightened wire, the reparative process literally following step by step in the track of the ulceration. The effused lymph also is serviceable, M. Spence says, by its pressure diminishing the calibre of the vessel, and thus lessening the impulse of the blood in the neighborhood of the ligature. How much more effectively therefore could, as we think, this great principle, which is the basis of the process; that is to say, pressure from without upon the tunics, be carried out by the new mode of curing aneurism; for it has the double advantage: first, of favoring by its retardation of the blood through the sac, the formation of a clot there, where it is certainly of most indispensable importance; and secondly, after the sac has been enabled to oppose an insuperable resistance to the impulsion of the blood, while the collateral circulation is at the same time being proportionally, gradually, slowly, and securely established and perfected, we have it in our power to increase and continue compression along such portions of the tube immediately above the sac as it may be desirable to obliterate by pressure, and external deposit of lymph, in order to give greater strength to the diseased parts, and a better guarantee against the return of the aneurism. Such considerations seem to us to be just views.

M. Spence is inclined to believe, and in fact admits, that coagula

can become organized; but as to their absorption, he thinks proof is wanting to establish that. The labors of M. Spence, as we perceive, possess the highest interest.

The re-introduction into surgery of the treatment of aneurisms by gentle compression, (see our note, *supra*,) makes every new and well-accredited research on the nature of the fibrine and the coagulation of the blood, a subject of deep interest and real value at this moment. M. Polli, in a memoir on the *Condition of the Fibrine in the blood in Inflammatory Diseases* (*Annali Universali di Medicina*, 1844-45; and *Gaz. Méd. de Paris*, Avril 26, 1845; p. 268, 269,) says, the blood in every case, as far as he has seen, coagulates in or out of the body *before* it decomposes. The *fibrine* is perfectly liquid in the blood during its coagulation. He has *effected* (how?) the coagulation of the blood even thirty-six or forty-eight hours after he had taken it from the dead body! The rigidity, or relaxed condition of the body after death, he imputes to the more or less speedy or tardy formation of the fibrinous clot in the blood-vessels, or its re-resolution in the capillaries of the subject.

Inflammation, according to this author, gives rise to three different modifications of the blood: 1. Augmentation of its quantity; 2. Greater resistance to its coagulation; 3. Its molecular rarefaction. But the reasoning advanced by the author to explain these conditions seems to us speculative and contradictory. He supposes thus, that the serum of the blood, (the natural solvent of the fibrine,) though surcharged with fibrine, which has *greater specific gravity* than the serum, (as is proved, he thinks, by its natural precipitation from the serum,) is actually rarefied or attenuated by this superaddition, and is rendered specifically lighter than when defibrinized or deprived of this excess! This attenuated sero-fibrinous fluid, as contra-distinguished from ordinary dense fibrine, according to him, forms the fibro-gelatinous semi-transparent deposit on the surface of blisters, anterior to the organization and excretion of pus, and also forms false membranes. The assumption of this supposed tenuity, caused by the commixture of additional fibrine to the serum, does not, in our judgment, explain by the supposed smaller size of the molecules, their capacity of transudation through the capillaries; because it is, on the face of it, at war with established facts, and because, moreover, the capillaries are all dilated by the impulsion of the blood, in acute inflammations and fevers, and therefore fitted to receive and expel the fibrine in its natural state, even supposing that there is then a surplus of this material. But the blood again is most fluid, limpid, and attenuated, in fact, most *dissolved* in atonic and adynamic fevers, where there is the least degree of inflammatory action, as in typhus, yellow fever, &c.

The high degree of attenuation and rarefaction of the blood, which he supposes to exist in inflammations, (entonic fevers, phlegmasiæ, &c., we presume he means,) and this too, even after the great superaddition of dense fibrine, is difficult to comprehend, except by the chemico-organic principle of a more perfect solution, or

dissolution of this fluid, by means of the more rapid generation, and consequently greater accumulation, of caloric in acute fevers. The action of the absorbents, however, is accelerated to the same degree of excess, and hence the rapid transformation of the muscular, or fibrinous, and all other tissues, which are pressed or drawn into the vortex of the circulation, as Leibig has so beautifully shown, to furnish additional supplies to the elements of combustion. And hence, too, as a proof of the truth of this fact, familiar to every one, the exhaustion, thirst, and especially the emaciation of patients in protracted fevers; the system receiving no food from without, but consuming itself. It is not necessary to suppose, therefore, an actual accumulation at this time of fibrine in the blood, but a more accelerated transformation, or metamorphosis of this and other materials into that common reservoir. Nevertheless, the great accession of caloric may, doubtless, render the blood, during the febrile excitement, far more limpid than in its normal state; the fibrinous and the other dense products that it throws off from the distended capillaries, however, are no proof that these matters existed then in greater quantity in the blood itself.

As we deem M. Polli's inferences based in error, we have thought proper to attempt their refutation; since, in the present rush for experiments and speculations on every subject of science, it is as much our duty in an elementary work like that of M. Velpeau, to guard against the dissemination of ideas that are purely speculative, as to favor the diffusion of principles that are founded on unquestionable facts and legitimate induction. T.]

§ IV.—Operative Processes.

A. *Ætius* (Sect. IV., Serm. 3, Cap. X.) says, that in order to cure aneurism, it is necessary to lay bare the artery above the disease, tie it in two places, divide it transversely, then to open and empty the sac, afterwards to raise up the vessel, tie it above, then below the opening, and to cut it through a second time.

B. *Paul of Egina* (*Paulus Æginet.*, lib. VI., cap. 37,) speaks of a process which consists in passing a needle with a double ligature behind the middle of the aneurism, tying one of these ligatures above and the other below the tumor, which is thus strangulated above and below, afterwards opened, and almost the whole of it excised. *Thévenin* (*Œuvres*, 1658, in fol., p. 57,) also mentions this process which, as we see, is very similar to that which was formerly used in applying a ligature to lupus and many other tumors. It is this, doubtless, which *Guy de Chauliac* (*Grande Chirurgie*, etc., p. 173,) has reference to when he asserts after *Albucasis*, that we may cure aneurism by employing the ligature, so as to burst it, (*à mode de rompure*.)

C. *Guy de Chauliac* points out another mode which, though it approaches that of *Paul of Egina*, nevertheless differs from it under some points of view, and seems in reality to be more rational. "It is necessary," says he, "that the artery should be laid bare, and

tied on both sides, that the part between the two ligatures should be cut through, (*tranché*) and then treated like common wounds.” The process described at such length by Bertrandi, towards the middle of the last century, being only the repetition of that of Guy de Chauliac, does not require any further mention. It is also so far from being new, that Philagrius (*Ætius*, tet. IV., Sermon. 3, cap. X.) had already had recourse to it.

D. *Guillemeau*, (*Œuvres Complètes*, in fol., p. 699,) rival and disciple of *Paré*, simplified the method of the ancients; he contented himself with tying the artery above the tumor, opening this last, emptying it of its clots, and then dressing it as an ordinary wound; it is this which forms at the present day the basis of the ancient method of treating aneurisms, a method which up to the last century, no one had the courage to apply except to aneurisms in the bend of the arm.

E. *Keysleire*, (*Lettre à Cotugno*, Pelletan, Clin. Chir., t. I.,) surgeon of Lorraine, in the service of Austria, about the year 1774, is the first who asserts that he had many times performed it with success for aneurism in the ham. *Keysleire*, in place of commencing by laying bare the artery above the tumor, proceeded, after having arrested the current of blood in the limb by means of the garrot or tourniquet, to lay open the aneurismal sac in its whole length, then carefully cleaned it, sought the opening of the vessel, introduced the end of a sound to raise it up, tied its upper end, moderately compressed its lower end, and treated the wound afterwards by the known means. *Guattani*, *Molinelli*, *Flajani*, and almost all the surgeons of Italy, employed the same method, which soon became generally adopted in France, Germany, and England, after having undergone, however, some slight modifications.

F. In place of confining themselves to compressing the lower end of the artery, *Molinelli*, *Guattani*, &c., found it more prudent to surround that also by a ligature. The two *Monros*, *Hunter*, *Desault*, *Pelletan*, *Deschamps*, and *Boyer*, thought it would be advisable also to leave some threads above and below the first ones, in order to make use of them if required, to check consecutive hemorrhages; from thence came those precautionary ligatures which have been described farther back.

G. *Anel*. A method different from this, and the elements of which are found in the processes of *Aetius* and *Guillemeau*, was put in practice at the beginning of the last century by *Anel*. (*Observ. sur la Fistule lachrymale*, etc., 1714.) Having to treat an aneurism in a missionary of the Levant, *Anel* applied on the 30th of January, 1710, in the presence of *Lancisi*, a simple ligature upon the brachial artery, immediately above the tumor, and without touching the sac. On the 5th of March following, the patient had entirely recovered. Nevertheless, this event, though remarkable, did not at first excite attention, notwithstanding the trial which *Leber* and *V. Hanspel* (*Verbrugge*, *De Aneurismate*, etc., 1773,) made of it, and was not rescued from oblivion until between 1780 and 1786. *Desault* (*Œuvres Chirurg.*, t. II., p. 568; et *Boyer*, t. II.) is the first who endeavored to restore it to its honors, in the month of June,

1785, by tying the popliteal artery without opening the aneurismal sac. On the nineteenth day there escaped from the wound a great quantity of matter mingled with blood, and a short time after the cure appeared to be complete; but the patient ultimately died at the expiration of seven or eight months.

The idea, however, of tying the aneurismal arteries at a certain distance from the tumor, dates far back. It is difficult, for example, not to recognize it in this passage of Paré: (*Œuvres*, liv. VIII., Chap. 34, p. 218, in fol.)—"I advise the young surgeon," says this great practitioner, "to be careful how he opens aneurisms, unless they are very small, and in a measure not dangerous; after incising the skin (*le cuir*,) over it, and separating it from the artery, we then pass a seton needle, threaded with very strong thread, under the artery on the two sides of the wound, letting the thread fall out of itself, and by proceeding in this manner, nature engenders flesh, which will be the means of stopping up the artery." Guillemeau went still farther than his master, for he concludes his article with this remarkable sentence:—"If such an aneurism should present itself to the surgeon in some other external part, he may safely (*sûrement*) lay bare the body of the artery at *its root and its upper part*, and tie it in the same manner without any other ceremony." Is it not evident that we here find the parent-thought of the method called that of Anel or Hunter? In the supposition that it was not in the mind of the author, it cannot be denied, at least, that it is deducible from his language.

According to the assertion of M. Martin, of Marseille, Professor Spezzani had entertained the design in the year 1781, of tying the femoral artery itself, without touching the sac, for popliteal aneurism, a project carried into execution under his eyes by Assalini, (*Pl. Portal, Clin. Chirurg.*, t. I., p. 154.) It was in the month of December, 1785, that Hunter, on his part, carried this suggestion into effect. As his operation was completely successful, it made much noise in the surgical world, and was in reality the signal of a revolution in our ideas respecting the treatment of aneurisms.

To set out from this epoch, we find the method of Anel, described under the name of the *New Method*, the *Modern Method*, and the *Method of Desault or of Hunter*, all of them inappropriate phrases, and which ought to give place to the title of the *Method of Anel*, its true inventor. In calling it a modern method, we make use of an improper expression, which specifies nothing, and which ought to cease to have the least value as soon as another mode of operation should be devised. To-day, for example, the *modern method* is the method of Brasdor, and no longer that of Anel. In calling it the method of Hunter, as the English surgeons do, and what is more singular, as many persons have been in the habit of doing in France, a double act of injustice is committed towards our nation. In fact, this method devised by Anel, if not by Guillemeau and Paré, was by Desault rescued from oblivion. Is it for having applied the ligature at three inches above the point selected by Desault, that Hunter merits the title of inventor in this affair? In that case, this honor would in reality redound to an-

other, for it is generally in the inguinal space, as Scarpa advised that we operate, and not as Hunter did in front of the adductor magnus (troisième adducteur.) Again, if it is true that Brasdor proposed from the year 1780, for many years in succession in his course at the schools of Surgery, that we should tie the femoral artery in the middle of the thigh, as his panegyrist in the Collections of the Society of Medicine affirms, is it not probable that young Englishmen, who then, as at present, were always found in considerable numbers at Paris, may have carried the suggestion to London, and that in this way it had come to the knowledge of Hunter? It should be the name of Anel, therefore, that ought to be affixed to this process, whatever M. Guthrie may say to the contrary, (*On the Diseases of the Arteries, &c.*, 1830,) and who, in order more effectually to oppose Dupuytren on this subject, goes to the extent of calling in question the part accorded in this matter to Desault.

H. *Method of Brasdor*.—Another method has since been introduced in science. Embarrassed by the difficulty or impossibility of placing the ligature between the aneurism and the heart, and by the danger of opening the sac when the disease was found too near the trunk, and unwilling, nevertheless, to rely upon the method of Valsalva, or upon topical refrigerants, some surgeons in that case supposed that it might be allowable to place the ligature below the tumor, between the tumor and the capillary system. According to Boyer, (*Malad. Chir.*, t II., p. 569,) it is to Vernet, a military surgeon, to whom we are to ascribe the first suggestion of this method, since it is to him that we are indebted for the attempt to compress the femoral artery below an inguinal aneurism. Brasdor, nevertheless, is the first who formally proposed to apply the ligature at that place. Desault, (*Œuvres Chir.*, t. II., p. 569,) at a later period, urged the same thing. Deschamps (*Ibid.*, p. 572) carried it into execution for a very large aneurism in the fold of the groin which threatened to burst. The pulsations immediately became much stronger in the tumor, which it became necessary at the end of a few days to lay open freely, and the patient died in consequence of this last operation, after having lost a very considerable quantity of blood. From that time the proposition of Brasdor appears to have been definitively adjudged; A. Burns (*Surgical Anatomy*, 1823, p. 186,) qualified it as absurd, and it was generally rejected as dangerous. The attempt of Deschamps seemed fully to confirm the fears, that reasoning *a priori* on the subject, had suggested. It had been said that by strangling the artery below the sac, (en deçà du kyste,) it is evident that the blood arrested at this point by an insurmountable obstacle, must distend with greater violence than ever the aneurismal tumor, and also attenuate its walls, and ultimately rupture them.

M. A. Cooper, (S. Cooper, *Dictionary*, art. *Aneurism*.) convinced like Brasdor, that when the circulation is arrested in the artery, below (au-dessous) the aneurism, the blood would soon flow into the collateral vessels, to reach the lower part of the limb, and that

it would fall into a state of stagnation, and coagulate in the tumor, and in all that portion of the vessel comprised between the ligature and the first branch of any considerable size lying towards the heart, did not feel inclined to yield to those reasons. He ventured, therefore, in 1818, to renew the attempt of Deschamps in a case of aneurism, which raised up (*soulevait*) Poupart's ligament, and appeared to occupy a great portion of the iliac fossa. The pulsations of the tumor continued, but the progress of the disease was arrested. At the expiration of a certain period of time, the tumefaction of the neighboring parts disappeared; the separation of the ligatures was not succeeded by any accident; the wound cicatrized, and about the sixth week the patient was sent to pass his convalescence in the country. It was ascertained afterwards that the tumor had ruptured, and that the man died about two months after the operation. The body was not examined.

Notwithstanding this unfortunate result, the operation of M. A. Cooper was nevertheless of a nature to inspire hopes, and to deserve new trials. M. Marjolin also said (*Dictionnaire de Médecine*, art. *Anéurisme*, 1821,) that before abandoning it entirely, it would be advisable to make some new trials with it, especially on the primitive carotid. M. Pécot (*Thèse* No. 155. Paris, 1822,) afterwards distinctly recommended it for certain descriptions of aneurism of the primitive iliac, the external iliac, and even the subclavian, when the size or situation (disposition) of the tumor prevented our laying bare the artery by the method of Anel; provided we could at the same time tie the collateral branches which might be found between the principal ligature and the sac. M. Casamayor (*Thèse* No. 151. Paris, 1825,) also, after passing in review all the facts and reasonings that had been adduced in favor of or against the method of Brasdor, asserts that it might perhaps be employed in those cases of aneurism where we should be enabled to suspend by this means the current of blood, or at least reduce its column to such dimensions that it would be incapable of preventing the contraction of the tumor. Dupuytren, on his part, has declared that the partial success of M. A. Cooper was rather calculated to encourage than to dampen the zeal of surgeons, and that by restraining the patient to a severe diet, and diminishing the mass of the fluid by repeated bleedings, either before or after the operation, we might by this means, probably, by allowing the blood accumulated in the tumor to become coagulated, promote a favorable issue.

Matters were in this state when, in spite of the reasons of A. Burns, and of Hodgson, and many other English authors, M. Wardrop, (*Archiv. Gen. de Méd.* t. XX., p. 557,) in 1825, carried into execution the ideas of Brasdor, in the case of an aneurism of the primitive carotid. It was in a woman aged seventy-five years, and in whom the tumor, approximating very close to the sternum, would not have allowed of placing a ligature between it and the heart. On the fourteenth day the aneurism had diminished one half, and the pulsation was no longer felt in it; it terminated by

bursting and emptying itself like an abscess; but the ulcer was speedily cicatrized, and the patient perfectly restored. Was it in reality an aneurism?

In the course of the same year, M. Wardrop (*The Lancet*, Vol. I., 1826) had to treat another woman who was fifty-seven years of age, affected with an aneurism situated immediately under the sterno-mastoid muscle upon the right side. The carotid artery was tied, Dec. 10th, with a ligature made of the intestine of the silk worm. On the 13th, the wound had entirely closed, and on the 21st, the patient believed herself perfectly cured; nevertheless she died on the 21st of March following, in consequence, however, of symptoms of hypertrophy of the heart, and of accidents which did not seem to have any connection with the operation itself. On the 1st of March, 1827, M. J. Lambert, (*Ibid.*, 1827, vol. XII.) of Walworth, had occasion to adopt the plan of M. Wardrop in a case of aneurism of the right carotid in a woman aged forty-nine years. On the third day the tumor had much diminished in size, and only slight pulsations were felt in it. On the tenth day a hemorrhage came on, which did not prevent the wound from closing. The tumor soon disappeared. On the 17th of April, the cicatrix had become ruptured, and a red fleshy growth occupied its centre. On the 18th, a new hemorrhage took place, and occurred several times up to the 30th; and on the 1st of May it became so abundant that the patient died at 11 o'clock in the forenoon.

On opening the dead body, it was found that the carotid artery had ulcerated above the ligature, that the aneurism had become entirely obliterated, and that the hemorrhage had been produced by the reflux of blood from one carotid to the other. M. Bushe (*The Lancet*, Vol. I., 1828; and Vol. II., p. 149,) on the 11th of September, 1827, performed the same operation on a woman aged thirty-six years, with perfect success. M. Wardrop (*The Lancet*, Vol. I., 1827; Vol. I., 1828; Vol. II., 1829. *Med. Chir. Rev.*, No. 21. *Bullet. de Férussac*, t. XX., p. 231,) performed it a third time on the 6th of July of the same year, on a woman aged forty-five years. This time he tied the subclavian artery in place of the carotid, which evinced no pulsation, and appeared to have become obliterated. A month after, the patient quitted London to reside in the country, and towards the latter part of August found herself perfectly restored. Various symptoms of affections of the chest afterwards occasioned some apprehension. On the 9th of September, 1828, the health of this lady, which was the occasion of a suit of slander, (*The Lancet*, 1828, Vol. I., p. 775,) had never been in a more perfect state; but she, nevertheless, died on the 13th of September, 1829. On the 2d of July, 1828, M. Evans (*The Lancet*, November, 1828,) also employed the method of Brasdor in a case of aneurism of the trunk of the carotid, in a man aged thirty years, and on the 28th of October, the patient resumed his usual occupations. Accidents afterwards supervened, and it became necessary to perform a new operation, and to tie two tumors, and excise them. The patient was ultimately cured. (*Letter of*

M. Evans to M. Vilardebo, May, 1831. *Thèse* No. 158. Paris, 1831, p. 58.)

A negro operated upon in the same manner by M. Montgomery, (*Guthrie, op. cit.*, p. 191. The *Lancet*, 27th of June, 1833,) on the 10th of March, 1828, in the Isle of Mauritius, at first seemed to do well, but died on the 11th of July following. The patient of M. V. Mott (*Journal des Progrès*, 2d ser., t. II., p. 213, or *American Journal of Medical Sciences*, 1830,) also, whom he had operated upon on the 20th of September, 1829, and whom he had supposed to be cured, died on the 22d of April, 1830. A woman operated upon by M. Key, (*London Medical Gazette*, July, 1830,) on the 20th of July, 1830, died the same day. An attempt of the same kind was made on the 12th of June, 1829, at the Hotel Dieu, by Dupuytren, for an aneurism at the origin of the right subclavian artery; the patient died on the ninth day after the operation, more perhaps owing to the great loss of blood than from the operation itself. MM. White (*Guthrie, Diseases of the Arteries*; Vilardebo, p. 28,) and James, (*Med. Chir. Trans.*, Vol. XVI., 1830,) who repeated the operation of M. A. Cooper, were not more fortunate. A patient operated upon by M. Laugier, at the Neckar Hospital, also died; but a case of M. Fearn, (*Arch. Gén. de Med.*, 3e serie, t. II., p. 364,) another of M. Morrison, (*Ib.*, p. 367,) a third of M. Tilanus, and a fourth of M. Rigen, seem to give support to the first successful cases of M. Wardrop.

Thus have we three methods of treating aneurism by ligature. It remains now to see which is the one which ought generally to be preferred, and in what cases it may be proper to have recourse to the others.

§ V.—*Relative Value of the Principal Methods.*

A. In the *ancient method* it is necessary that the seat of the tumor should admit of our making between it and the heart a sufficient degree of pressure temporarily to suspend the entire circulation in the limb. The opening of the sac requires a very extensive wound, leads to an abundant suppuration, renders the isolation of, and ligature upon the artery sometimes very difficult—frequently obliges us to place the ligature upon a part of the vessel more or less altered, exposes in a remarkable degree to secondary hemorrhages, and to gangrene from deficiency of circulation, and does not cicatrize but very slowly. If the aneurism is deep-seated, this method obliges us to divide the muscles and aponeuroses, and to produce a good deal of destruction in the midst of the tissues; in a word, it is a painful, long, laborious, difficult and dangerous operation. The reasons in favor of it are, that it preserves all the important collateral arteries, permits no reflux into the sac, and exposes less than the others to erysipelatous, phlegmonous and purulent inflammations (fusées) in the depth of the muscles. Perhaps, therefore, it would still be advisable frequently to give it the preference near the upper part of the limbs, and to adopt it generally in traumatic aneurisms,

whether primitive or consecutive, (constitutifs.) M. Guthrie, (*Oper. cit.*, p. 270, 283,) who will allow of no other in such cases, no doubt goes too far; but in rejecting it altogether from practice, modern surgeons have gone to the other extreme, which is equally as objectionable.

B. By the *method of Anel*, we act on tissues in the normal state, and whose relations have not been disturbed. It is easy to include only the arterial trunk in the noose of the ligature, and to avoid the nerves, veins and all other tissues whose strangulation might compromise the success of the operation; the previous compression of the vessel is not indispensable; and we may look for it in the place where it is most easy to lay it bare, or where it is most superficially situated. The wound which is smooth, (nette,) and of little extent, cicatrizes promptly and with facility; the operation is simple, easy, and infinitely less painful and not so long as by the other method; and when the artery is tied upon a portion of it which is perfectly sound, the secondary hemorrhages must be less formidable and less frequent. The continuity of the tissues not being so much disturbed, (interessée,) the circulation below the ligature is more easily re-established; and the constitutional reaction is necessarily less intense, (vive,) and the gangrene of the limb less to be apprehended.

I. To those who say:—By opening the sac; 1, we may apply the ligature as low as possible, and the tumor is immediately emptied; 2, we do not add another lesion to the first; 3, that tumors placed too near the trunk, (i. e., of the artery. T.,) to treat them by the method of Anel, will, by the process in question, allow of the two ends of the artery being tied; 4, that when an arterial trunk has been wounded, and we know the place that the opening occupies, it appears more rational at first sight to lay it bare in this place than to proceed by means of a new wound to search for it higher up; the *partisans* of the method of Anel reply:—1, After a ligature upon an artery, the circulation ceases, not only in the part which is nearest approximated to the ligature, but moreover also as high up as the first collateral of any considerable size which is met with in the direction towards the heart; 2, in placing a ligature upon the popliteal artery, the femoral itself, for example, becomes obliterated as high as to the origin of the profunda, for which reason there is in this respect no advantage in cutting down to the vessel at the lower third of the thigh; 3, that in respect to tumors situated very near the upper part of the limbs, there are none of them at the present day to which the method of Anel would not apply, so long as they admit of being operated upon by opening into the sac; 4, that in diffused aneurisms it cannot be denied that the embarrassments caused by the effusion of blood, the displacement and disorganization of the tissues, the difficulty of cutting down (tomber) exactly upon the point wounded, and of finding the vessel itself at the bottom of a wound more or less irregular in its shape, and the depth to which it would sometimes be necessary to penetrate, are inconveniences calculated to justify the practice of

those who, even under such circumstances, operate upon a part of the limb higher up; so much the more so because hemorrhage which might return by the lower end of the artery, could easily be arrested by pressure properly applied.

II. The *opponents* of the method of Anel might however rejoin, that in placing the ligature at a certain distance from the disease, we incur the risk of seeing the blood and pulsations return in the sac, and of having thus performed, to no purpose whatever, an operation of a dangerous nature. The blood by means of the anastomosing branches (arcades) may return into the arterial trunk between the tumor and the ligature, re-enter the aneurismal sac by its lower opening, or arrive there directly by some secondary branch. Though experience may have shown that these pulsations soon cease, and that they are generally easily overcome by a moderate compression, the contrary also is equally possible. Reason, moreover, perfectly explains this result. The blood which arrives to the aneurism, under such circumstances, cannot do so but after having traversed the capillary system, until after having passed from very small channels into branches of greater and greater calibre, and consequently not until after having lost in a great degree its natural force, (*vitesse habituelle*;) but if it be sufficient in order to effect its coagulation that it should remain in a state of oscillation or stagnation, and that it should cease to circulate in any given point whatever of the vascular system, we may also conceive that in certain cases it might remain liquid, keep up the disease to an indefinite period of time, and bring on inflammation of the sac; and that if the inconvenience in question is far from meriting the importance that was at first given to it, we should do wrong on the other hand to pay no attention to it.

As to the subsequent opening (*ouverture consecutive*) of the sac, and its inflammation and suppuration, both of which have, with good reason, been deemed of a nature calculated to jeopardize the success of the method of Anel, they are inconveniences which, when they do happen, render the operation still less formidable than that of Keyseire. They are, moreover, rarely met with but in cases where the disease is far advanced, or where the aneurism is contained within walls that are greatly attenuated and more or less disposed to mortification.

III. *In reality* the method of Anel has numerous and indisputable advantages over the ancient method. Nevertheless this last should not be entirely rejected; we should give it the preference, for example, in diffused superficial aneurisms, in those which are situated upon the brachial artery very near the axilla, and even in those of the axillary artery, when the shoulder is infiltrated or so altered (*deformée*,) that it would be dangerous to attempt the operation in front of or above the clavicle; also in all aneurisms of very large size that are in danger of becoming gangrenous, or that are in the vicinity of a large and important collateral vessel; in fine, in a varicose aneurism (*aneurisme variqueux*) which requires that the artery should be tied above and below its opening. This doctrine, zealously advocated by M. Guthrie, seems to me to be exceedingly

sensible, and altogether conformable to the principles of sound surgery; many facts which will find their place elsewhere, have satisfied me that it is correct.

C. *The method of Brasdor*, being a mere modification of that of Anel, has consequently as an operation, all its general advantages and inconveniences. It is in fact nothing more than a substitute or dernier resort which is applicable only to cases which do not admit of the two other methods. The cures that are obtained by it are explained in the following manner:—the blood circulates with less force in the aneurism than above and below it, and this in consequence of a physical or hydraulic cause which is easily understood. From this condition of things, the first effect of a ligature when applied upon the distal (excentrique) portion of an artery, should be to completely arrest its circulation first in the tumor, which from that moment is converted into a barrier, (*transformée en impasse*;) and secondly, as far as to the supplemental branches, through which the blood may obtain egress, and be diverted from its accustomed channels. Let, for example, the carotid be tied near its bifurcation, and it will become obliterated gradually down to its origin, that is to say, down to the point where it separates itself from the aorta, or the subclavian; it will be the same respectively with the tibial, radial, ulnar, popliteal, brachial and femoral arteries, &c. But if by constricting an artery near its distal (*périphérique*) extremity, we are enabled to obliterate its canal down to its origin, it is evident that an aneurismal tumor existing between those two points, ought to be made to disappear with almost as much ease and certainty when we placed the ligature upon the distal as upon the cardinal side of the disease. It is, in fact, to be presumed that by the method of Brasdor the pulsations would be less apt to return or to be kept up in the sac than by the process of Anel, unless there should happen to be found a number of large sized collaterals between the ligature and the aperture of the artery. In this last case, without doubt, the operation would present fewer chances of success, but it nevertheless would, in my opinion, often succeed; provided the supplemental branches should be only one half or a third of the size of the principal trunk; that they should not furnish to the blood a circuitous route, (*voie de détour*,) which would prevent its stagnation in the aneurismal sac, and that the walls of this last should have sufficient thickness or density to resist the violent efforts and pulsations which they are ordinarily obliged to sustain immediately after the operation.

We must not, however, exaggerate the value of this new method. Out of about twenty subjects who have hitherto been submitted to it, at least fourteen have died, while a fifteenth was exposed to the most imminent danger. A great number of facts here and there to be met with in scientific works prove that the arteries are far from always becoming obliterated to a great extent on the cardinal side of the ligature. Warner cites the case of an aneurism of the brachial which succeeded to an amputation above the elbow, and in which it became necessary to tie the vessel near the axilla. An amputation

of the leg presented the same difficulty to M. Roche at Tarragona, in 1813, so that it was found necessary to tie the posterior tibial between the aneurism and popliteal artery. We find in M. Hodgson two examples of aneurism, closed on their distal side, and which, nevertheless, ultimately ruptured or became gangrenous. M. Guthrie says that many specimens in the collection of Hunter show a complete obliteration of the artery on the distal side (au-dessous*) of the sac, without a cure of the disease having been thereby effected. In his ligature upon the external iliac by the method of Brasdor, M. White found the artery impermeable, and yet the aneurism continued to increase. In a woman on whom I performed amputation at the knee, a month before, strong pulsations of the popliteal artery were still perceptible at the bottom of the wound. And who has not been witness to the same phenomenon after amputations of every kind? But if the arterial trunk (kyste) continues pervious on the distal side (au-dessous) of the collateral branches, at an inch or two from the suppurating surface of an amputation, or from a spontaneous obliteration of the vessel, we can scarcely comprehend why the same difficulty would not exist after a methodical application of the ligature.

To understand ourselves on this subject, and to appreciate the method of Brasdor, it is necessary, after the example of M. H. Berard, (*Dict. de Méd.*, 2d edit., t. III., p. 59 à 72) to divide the facts which relate to it into two classes. 1, If there is no collateral branch remaining between the ligature and the sac, we have every possible chance of success; the aneurism is then converted into a cul de sac, where the blood is conereted and closes the upper end of the artery. 2, If collaterals exist between the tumor and the ligature they serve to divert and keep up the circulation to that point, and hinder the blood from conereting in the sac. 3, And even supposing that there should be no collaterals beyond the tumor, we should still have to fear the presenee of arteries which take their origin from the sac itself, or from the immediate neighborhood of its upper orifice. M. Berard (*Jour. Hebd. ; et Archiv. Gén de Méd.*, 1830) it is true, has shown that the roots of these arteries raised up and displaced from the line of (transportées hors) the principal arterial axis, soon lose their permeability, by becoming like the aneurism, filled with bloody concretions; but this fact, or this process must be subject to execeptions, and we cannot, in my opinion, fully rely upon it. It is very obvious from these facts, why the operation of Brasdor upon the femoral artery and the axillary artery has not succeeded, while in the primitive carotid it has been attended with very advantageous results. We should do wrong, however, at present to receive this opinion as conclusive; I shall, when speaking of arteries in particular, show that though the carotid and subelavian give off enormous collaterals, this has not al-

† * In most places when the author, on this part of the subject of aneurisms, speaks of the artery above (au-dessus) the ligature or sac, he means the cardiac side, or nearer to the heart; and so au-dessous, or under the ligature or sac, is the distal side in the operation of Brasdor, i. e., farther from the heart. T.

ways prevented the patients from recovering, and that it remains to be proved that the establishment of the circulation through these collaterals has been the cause of failure in other cases. The question whether death or the cure in these cases depends, as M. Guthrie (*Oper. cit.*, p. 207–208] maintains, upon an inflammation which is transmitted from the interior of the sac to the heart, will be discussed in treating of the *arteria innominata*.

§ VI. *Operative Process.*

Is it requisite before applying a ligature to an artery that the patient should undergo a preparative course of treatment? Should we wait until a very advanced period of the aneurism, or is it better to operate as soon as we are perfectly satisfied of its existence? The previous compression recommended with the view of favoring the development of the supplementary vessels, is, comparatively speaking, useless. Latterly, in our times, it has generally been rejected; in fact, it would be idle to make trial of it, except in cases where it might possibly offer some prospect of aiding in the cure. By the ancient method there was no risk incurred by deferring the operation; the interruption to the course of the blood, caused by the development of the tumor, favored to the same extent the establishment of the collateral circulation, and the prospect therefore of obtaining in a number of cases a spontaneous cure. At present we attach no importance to those feeble reliances, and by the new processes more especially we undertake the operation as soon as possible. Some persons go to the extent, but erroneously, as I conceive, at least in formidable cases, of rejecting all precautions of regimen or general treatment. One or two bleedings if the patient is robust or of the sanguine temperament; a diminution to a greater or less extent in the quantity of aliments, with drinks slightly bitter and diluent, and anodynes (calmants,) tepid baths and anti-spasmodics if there are nervous symptoms and a great deal of irritability; preparations of digitalis to weaken the impulsion of the heart; a mild purgative when the bowels are costive; and leeches if any local inflammation should supervene, will not be omitted by the practitioner who knows how to unite the principles of sound medicinal treatment to the rules of judicious surgery.

A. The ancient method.—I. *Instruments* (appareil.) In the ancient method the instruments employed are a convex, a straight, and a blunt-pointed bistoury, a female sound, (*algalie de femme*,) blunt probes, a spatula, needles of different forms, ligatures, a tourniquet, a garrot, agaric, lint, compresses, bandages, sponges, scissors, &c. The skin upon the aneurism and surrounding parts should be carefully shaved.

II. *Position of the Patient and the Assistants.*—The patient being placed upon a bed properly prepared, or upon a table, an assistant who can be relied upon, is charged with the duty of compressing the artery between the tumor and the heart, by means of his fingers, a rolled bandage, a bureau seal provided with a pelote,

the garrot of Morel, the tourniquet of Petit, or some other similar instrument; a second assistant grasps the sound limb, or places himself in front of the operator; a third, hands or receives (*re-prenne*) the instruments as they are required or no longer needed; a fourth and a fifth, when there is room for them, attend to holding in proper position the head or any other part of the body whose movements might produce some disturbance.

III. *Operation*.—The course of the artery being well ascertained, the surgeon divides with the convex bistoury, first the skin and the adipose tissue, then with a second incision the whole thickness of the sac, commencing his incision a little above and not terminating it until he has reached an inch below the tumor. After having removed the clots of blood and sponged and wiped the bottom of the wound, he seeks for the opening of the vessel, slackens the compression a little, if necessary, in order to discover the artery with more certainty, introduces into this opening a blunt probe, or a female or a grooved sound, then raises the upper end of the artery, assures himself again that it is this which he has under his eyes, isolates it from the vein, nerves and other tissues which it is important to avoid, passes the ligature under it as if with the intention of including the sound at the same time with it, seizes immediately the two heads of this ligature which he draws towards him with one hand, while he applies the forefinger of the other upon the raised trunk in order to identify its pulsations, and to be certain that the artery is properly secured, and that the ligature which is about to be placed around it will effectually constrict its calibre; afterwards there remains nothing more to do than to tighten the ligature by a simple knot, while, at the same time, the sound is withdrawn, then to secure this first knot by another, after which one of the threads of the ligature is to be divided by the scissors very close to the artery. We proceed in the same manner for the lower end of the artery; the bottom of the wound is then to be filled with agaric, or better still, with balls of soft lint, which are covered with the perforated linen and large plumasseaux of lint spread with cerate, and which are kept on by the aid of a few compresses and a simple containing bandage which completes the operation and dressing.

B. *Method of Anel*.—When we operate without opening the sac, certain precautions required in the ancient method, become useless. The position of the patient and the assistants is not materially different, but there can be no longer any object in making compression of the artery above the tumor, (i. e., on the cardiac side,) except as a matter of prudence. The place at which the ligature should be applied upon it, not being determined by the presence of the aneurism, requires somewhat more attention on the part of the surgeon.

I. *The place of choice*.—In spontaneous aneurisms we should cut as far as possible from the tumor, because the nearer we approach to it the more danger is there that the coats in this part of the artery are diseased. In traumatic aneurism we must adopt a contrary rule,

because in addition to the certainty that in placing the ligature very low down we shall find the artery as sound there as anywhere else, we have the advantage, also, of preserving intact collaterals of greater or less importance. Nevertheless, if it should be considered that the operation would be much more difficult near the aneurism, we should, unless we are obliged to sacrifice a large sized supplemental branch, proceed to seek for the vessel where it is most easy and least dangerous to cut down to it. The more distant we are from the sac the less danger is there of causing its rupture, inflammation and suppuration. We must not, however, in order to avoid one extreme, fall into the other; that is to say, place the ligature immediately beyond, (i. e., on the distal side of,) a large secondary arterial branch. In fact the consequences of such an operation rarely fail to become alarming, not because, as has been too frequently asserted, the bloody clot, which Jones has dwelt upon so much, cannot be formed, but because the blood, finding a free and very wide passage immediately above (i. e., on the cardiac side of) the ligature, does not allow the walls of the artery to approach each other and to contract adhesions between them.

II.—*Incision.* The Surgeon placed on the side of the aneurism commences by stretching the integuments either cross-wise by means of the thumb, fore-finger and ulnar border of the hand, or by applying the extremities of the four fingers upon the track of the vessel parallel to its direction, and then makes an incision into the skin of from two to four inches in length. This incision should be made with a bistoury convex upon its cutting edge rather than with a straight bistoury; it is better that it should be rather long than otherwise. An incision, moreover, of from two to three inches in extent, so long as we are not obliged to go deep, will be found to answer in the greatest number of cases. Most frequently we make it correspond with the direction of the artery, but sometimes we go in the direction of the muscular fibres, in which case it crosses the vessel more or less obliquely. We must take care not to go too deeply at the first cut; and it is much better to make two cuts in dividing through the skin than to come down to the artery with the first incision.

After the integuments we divide the aponeurosis in the same manner, if the artery is still at a certain depth. In the contrary case or when the operator is not very sure of his hand he inserts under the aponeurosis a grooved sound which serves as a conductor and guide to the bistoury. The other laminæ should be divided successively with the same precautions and to the same extent.

III.—*To isolate the Artery.* Having reached the vascular and nervous fasciæ, we must now attend to the opening of the common sheath. The grooved sound is then of the greatest importance. We insinuate the sound (i. e., director) from above downwards, or from below upwards in the interior of the sheath, taking care to raise up this only, and not to let any of the parts which it would be dangerous to wound, slip in between the sound and the instrument. To separate the parts afterwards, we also make use of the same director, which should be slightly flexible, or slightly conical in shape,

without any cul de sac, and not so blunt, (moins obtuse) as the ordinary grooved sound; holding it in the hand as a writing pen, we pass its extremity between the vein and the artery, then making gentle movements with it backwards and forwards, with a moderate but steady pressure, we detach and separate the two vessels from one another to the extent of a few lines. In proportion as this separation is effected, we incline the sound more and more backward, in order that its point making its way by degrees under the posterior surface of the artery, may as it reaches around it show itself on the opposite side; then use the fore and middle finger of the other hand to separate the nervous trunks from it, or to push backwards and outwards all the parts that we wish to avoid. It is important therefore to manage the sound with a great deal of address, otherwise instead of going round it we might run the risk of plunging it into the vein or the artery, as M. Rienzi, (*Méd. Opér.*, trad. Ital., t. I., p. 105,) accuses a skilful surgeon of Italy of having done.

IV.—*To apply the Ligature.* Before withdrawing it the sound is to perform another duty; for it is on this that we pass down the ligature, whether for this purpose we use a simple silver probe, having an eye at one of its extremities, or prefer for deep ligatures the curved needle, attached to a forceps, as figured in the work of Dorsey, (*Elements of Surgery*, Vol. II., pl. 23,) or the needle of J. L. Petit, or that of Deschamps, &c. Desault (*Œuv. Chir.*, t. II., p. 555,) contrived for those cases where we are obliged to manipulate at the bottom of a narrow and deep cavity, a spring needle much resembling the sound of Bellocque, and which has been modified in England, by MM. Ramsden, Earle and Brenner, (S. Cooper, *Dict.*, p. 151.) M. A. Cooper in these difficult cases makes use of a steel stem, supported by a handle, and strongly curved backwards at its free extremity, and terminated by an olive bit (une olive) in the thickness of which is situated the opening destined to receive the thread. M. Mott has frequently employed an instrument of the same kind, and the needle of M. Caussé (*Rév. Méd.*, 1828, t. III., p. 388) is but a modification of that of Petit. Scarpa has greatly extolled a small spatula of pure silver, very thin, and so flexible that it can adapt itself to all the parts we wish to include. But the grooved sound, aided by the probe such as I have pointed out, will generally be found to answer in the hands of a skilful surgeon; it has besides, in preference to all special instruments and the numerous needles whose forms have been so carefully delineated by M. Holz, (*Trait. des Liqat. Arteriellles*, Berlin, 1827,) the immense advantage of enabling us to denude (dépouiller) the artery in the neatest manner possible, and almost without any laceration of the surrounding tissues. As soon as it has reached the other side of the vessel we cannot see why it would be impracticable to slide along upon its groove the head of a flexible probe and in this manner pass the ligature; so much the better could this be done as there is nothing to prevent our having an eye near its point, to conduct the ligature at the same time that

the point detaches and lays bare the circumference of the artery. However every one understands then nature of these instruments, and can make up his own judgment which to give the preference to.

It is not only improper but also dangerous to attempt, as Scarpa has advised, to raise up and separate the vessel from the surrounding parts by means of the fingers. By this means we tear the tissues and make a contused wound, which will almost inevitably proceed on to suppuration; when in fact it is important to make this wound as neat and as regular as possible. Those who recommend shaving with the bistoury flat-wise (*en dédolant*) all the layers of cellular tissue that envelop the artery, run the risk of wounding it in spite of the most minute precautions, or even in the most favorable cases, of unnecessarily prolonging the operation. The sound (i. e., director) protects us from these inconveniences, enables us to act with greater security and promptitude, and to pass the thread around the artery, so to speak without displacing it, or disturbing its natural relations or laying it bare more than to the very smallest extent possible.

V.—*To Tighten the Ligature.* It is not possible to determine what degree of force should be employed to strangle the artery. The ligature should be drawn so tight as to hermetically shut up the artery to the passage of the blood not only at the moment of the operation but also afterwards; this is the only rule that we may be permitted to lay down upon this subject! When it includes with the artery some portion of muscular tendinous, aponeurotic, or even cellular tissue, the object in view may be defeated, because those fibres in wasting away soon cause the ligature to become loose, and thus render it almost useless, at the same time that they prevent it from coming away at a proper time. To obtain this last result we must also avoid passing the ligature twice round upon itself so as to form what was called in other times the *surgeon's knot*. Even with this knot, notwithstanding the greatest degree of constriction employed, the centre of the circle remains sometimes gaping open, or permeable. This it is said (Pelletan, *Clin. Chir.*, t. I., p. 122) happened to Chopart, when among the first in France he proposed in 1781, to apply a ligature on the popliteal artery. Many ligatures were successively used without however succeeding in effecting the entire suspension of the circulation in the limb; (can that be true?) when it became necessary to have recourse to immediate amputation, and an examination of the parts afforded an opportunity of ascertaining that not one of the ligatures had completely effaced the cavity of the vessel. We confine ourselves therefore to two simple knots. If the ligature is of animal tissue we cut off the two ends in order to enclose the remainder in the wound; in the contrary case we reserve one of the extremities which is to be left hanging outside. If after having laid bare the artery, we discover that it is diseased, and that its walls are yellow, friable (*fragiles*) and encrusted with calcareous lamellæ, (*plaques*), it would perhaps be prudent to flatten it as Scarpa recommends, instead of strangulating it as in the other processes; for that purpose we place upon

its anterior surface, between that and the ligature, a small compress (rouleau) of linen, cork, gum elastic, or adhesive plaster, from four to six lines long, from one to three in thickness, and about the same in width. MM. Lawrence, A. Cooper, and Briot, however, have obtained satisfactory results in pursuing an opposite course, and in venturing to use only a simple thread upon arteries that were obliterated, and brittle, and entirely altered from their natural state. It is in such cases especially that the ligatures of M. Jameson (vid. supra,) might be of great advantage, when we have no chance of doing better, by making a new incision in order to perform the operation higher up.

VI.—*Dressing.* The wound being cleaned and freed of all the foreign bodies that may be contained in it, should be partially brought into union immediately. Nothing is more formidable than the suppuration that follows ligatures upon arteries; immediate union on the contrary would almost always ensure us success; but it is from the bottom towards the borders that this union is desirable, and not from the skin towards the deep seated parts, as the tendency is, from the manner in which the stitches of the suture are arranged by some surgeons. The presence of the ligature around the vessel and of a foreign body between the lips of the wound, is moreover under these circumstances an obstacle almost insuperable to an immediate agglutination. The consequence is that we limit ourselves to keeping the sides of the wound correctly approximated by means of graduated compresses, adhesive plasters and the position. After having wrapped up the ligature which hangs outside, we turn it back towards the most dependent or nearest angle of the wound, or merely place it crosswise between two strips of adhesive plaster. The perforated linen is then applied, or we make use of the fringed linen bandelettes, (bandelettes de linge decoupées,) (vid. supra. Vol. I.) A plumasseau of soft lint, and one or two long or square-shaped compresses, cover over the preceding portions of the dressing, and we terminate as in the ancient method by some turns of bandage to support the whole.

C.—*Method of Brasdor.* The manual of the operation is precisely the same in the method of Brasdor as in that of Anel.

D.—*Subsequent Treatment.* The patient is carried back to his bed and placed in such a position that the muscles of the part upon which we have been operating may be in a state of relaxation.

I.—The limb supported upon cushions, ought, according to some, to be surrounded with bladders containing hot aromatic substances, (entouré de vessies aromatiques chaudes) sachels (sachets) filled with sand, ashes or bran, at the temperature of 30 degrees; (Reaumur;) according to others, it should be merely supported with soft pillows sufficiently warmed; there are also others who, indifferent to all special precautions, add nothing to the natural furniture of the bed unless the sensation of cold which comes on at that time should be very uncomfortable. This last mode is the one which should be adopted as obviously the most rational. One

of two things takes place, either the circulation is restored to the parts which have been momentarily deprived of it by the operation, and their temperature by this means is raised to the proper elevation ; or it is not re-established, in which event the artificial heat can scarcely be otherwise than calculated to hasten the development of the gangrene. On the supposition then that the sensation of cold does not incommode the patient, we may dispense with heated cushions. In the contrary case we may, during the two or three first days, place in contact with the parts that are suffering from cold, cushions of sand kept constantly warmed.

II.—In other respects we may proceed as we do after all serious operations. Diet, repose, and the most perfect tranquillity, and mild acidulous drinks slightly anodyne or anti-spasmodic, are necessary at first. General bleeding may also become necessary with the view of preventing or relieving the congestion (*refoulement*) of the blood in the viscera. Most frequently it is found advantageous in the first twenty hours to administer some spoonfuls of a drink, blended with slightly aromatic mixtures, as the tincture or extract of opium, or occasionally with a little ether or the liquor of Hoffman, in order to calm the nervous state of excitement and agitation which the patient frequently falls into. In such cases the most suitable drink is linden (*tilleul*) water tepid. On the morning after I allow the patient light broths, (*bouillons*), and soon after soups, (*potages*), eggs, and diluted wine and water ; then meat if no general re-action should supervene ; a rigorous diet would jeopardize the success of the operation. [This sanction of a rather generous course is perfectly in accordance with, and in anticipation of, the now recently adopted and certainly most rational views of the consecutive treatment of aneurisms ; for by this it is truly said as in the cure by compression, (*vid. notes, supra et infra*), we thus favour the deposition of plastic lymph in the aneurismal sac, &c. T.]

III.—The first dressing is not made until the third or fourth day at the earliest. The greatest care should be taken not to disturb the limb by any movement, and to make no traction upon the ligatures, nor when removing the portions of the dressing to derange the position of the lips of the wound, at least in those cases where we are attempting immediate re-union. The same attentions are also necessary afterwards, until the ligatures come away, which they do from the tenth to the twentieth or thirtieth day, but which also may not happen until the fortieth or even the fiftieth ; and we may promote this separation as soon as the obliteration of the artery appears to be complete, by pulling from time to time gently upon the threads, if they are slow in becoming detached. When the time of reaction is passed by and the first symptoms are subdued, and the limb has regained its natural temperature and sensibility, the patient should from that time be considered as convalescent. Nevertheless, even after the cicatrization of the wound is complete, he ought not for a considerable length of time, to be permitted to make any other than very slight or trivial movements, if he does not wish to run

the risk of losing his life by a secondary hemorrhage, and of having his wound reopen afresh, as happened in a case cited by Bécлар.

§ VII.—*Consequences and accidents of the operation.*

The results produced by the operation for aneurism are sometimes complicated with accidents or symptoms that require particular attention.

A.—In general the limb during the first twenty-four hours *becomes cold* to a greater or less degree, as has been already said, then it afterwards by degrees re-acquires its usual temperature; but it is not uncommon to see too great a degree of heat succeed to this state of things, causing by this means so much irritation in the part as to result in gangrene. Vacca and some modern writers have given examples of this kind; in such cases the limb should be wrapped in flannel, wet with emollient liquid, or covered with cataplasms of the same emollient nature; perhaps even it would be found useful to apply leeches upon those points which were most painful or which were most likely to become inflamed. For certain reasons also, I am induced to believe that a roller bandage applied moderately tight would overcome this difficulty better than any other means; cold water of itself would also be another resource that we might make trial of.

B.—*Gangrene*, the too common consequences of ligature upon arteries, is not always preceded by this excess of heat; it is often caused by the circulation not being re-established. Then the lower part of the limb remains cold and insensible and becomes discolored, and the seat of phlyctenæ, and soon after of all the other characters of mortification. The patients who are about to be affected with it are ordinarily seized with violent pains, which nothing can assuage, throughout the whole extent and especially towards the lower extremity of the limb. In one case it will not show itself until the eighth day, in another not until the twelfth, though the pain from the arteritis (inflammation of the arteries. T.) may have continued incessantly from the day of the operation. This gangrene, as M. Laugier has remarked, (*Archiv. Gén. de Méd.*, t. XXX., p. 162,) is announced by a livid, violet, greenish, milky yellow, (*jaune lacté*) color, rather than by the signs of ordinary gangrene; it seems more like an organic decomposition (*decomposition cadavérique*) than a disease. If the gangrene has not extended to a great degree, or seems disposed to become circumscribed, we proceed as in those cases where it is produced by any other cause. We wait until the escars are detached, and the ulcers which result from them are cicatrized; but if it invades the whole thickness of the limb there is nothing but amputation that can save the life of the patient, though that also is a resource which often fails.

C.—The sudden interruption of the course of the blood through an artery of large size, sometimes occasions so great a disturbance in the general circulation as to excite an *intense fever*, with symptoms of plethora and congestion, and a strong tendency on the

part of the principal organs to become the seat of severe inflammations. It is under such circumstances that the antiphlogistic regimen should be adopted in all its rigour, and that we should have recourse to bleeding, general or local, and even to be repeated frequently, while the strength of the patient, or the severity of the disease, seem to justify it.

D.—In other cases, it is the *nervous symptoms* which make their appearance and create alarm; the pulse becomes irregular, small and frequent; delirium supervenes, convulsive movements take place, and most of the symptoms of ataxic (ataxique) fever may become developed. Experience has shown that anti-spasmodics in general, and especially opiates, are the best remedies for this kind of accident. It would appear from a case that occurred at the Val de Grâce, that in order to subdue the symptoms M. Gama was obliged to administer landanum to a very great extent, and that the delirium which takes place in such patients has some analogy to that with which drunkards are so often affected, in other words, *delirium tremens*.

E.—Ordinarily the *tumor shrinks*, (s'affaïsse,) or at least diminishes, and ceases to pulsate immediately after the ligature; at a later period, it hardens and retracts; the blood contained in it concretes and is gradually absorbed, and the whole terminates after the expiration of a greater or less period of time, by disappearing altogether, or leaving only a small tumor or simple hard, moveable kernel, (noyau,) without any pain. In the place of these phenomena, others sometimes supervene; the *pulsations*, which had temporarily ceased, reappear at the end of some hours or days; the tumor retakes its original volume, and the operation appears to have had no effect upon the disease. This is owing sometimes to large collaterals, which open either directly into the tumor, or between the tumor and the ligature, and which bring the blood there in too great quantity; sometimes to this fluid returning to the sac by the lower end of the artery. It is, however, a less serious accident than it was first thought to be. Observation has proved that, in a majority of cases, the system succeeds in triumphing over it. Nevertheless, if topical refrigerants, the methodical application of the roller bandage, or any kind of compression whatever, continued for some weeks, should not bring about any favorable change in this respect, it would be advisable to ascertain if there would not be more security, in case the thing were possible, in applying a new ligature very near the tumor, either above or below it, or, in fact, in operating by the ancient method.

F.—In place of shrinking or becoming hardened, or ending in fact in resolution, the aneurismal sac becomes heated, and sometimes even inflamed, with a tendency to become converted into an abscess. If cold topical applications, astringents, and compression do not produce at first the benefit that we had a right to expect from them, leeches and emollient cataplasms should be promptly substituted in their place. Also, if suppuration, or an actual purulent fluctuation take place, it will be necessary to treat the aneu-

anism, as a simple abscess, (dépôt,) to open it freely with the bistoury without waiting too long a time, and to empty it of the matters that it contains, and afterwards to dress it as any other suppurating wound.

G.—Immediate union is *not effected* always, though we may have done everything to obtain it. Pus sometimes stagnates at the bottom of the wound, extends itself to a great distance, and separates (décolle) the tissues; the muscular sheath and that of the artery, in their turn, become inflamed, and soon end in suppuration; it is then that the patient is exposed to the most imminent dangers. From thence come *erysipelas*, *diffused phlegmons*, *angioleucitis*, *phlebitis*, and *purulent infections*, whose danger it is difficult to estimate. It is important, therefore, to resist this unfortunate tendency as soon as it is ascertained, to dilate the integuments freely, and all other tissues which oppose a free and easy exit to the pus or other effused matters—to lay bare the bottom of the wound throughout its whole extent—and to give up every idea of union by the first intention.

H.—When, in spite of his efforts, the surgeon finds that suppuration takes place, and is diffused and protracted to so great a length of time as to enfeeble the whole organism and lead to the apprehension of adynamia or exhaustion, it behoves us to look to the arrestation of this drain by general medication, and to sustain the strength of the patient by administering the extract, syrup, decoction, and other preparations of cinchona, (kina,) also an allowance of good wine, and light, but substantial aliments, &c.; at the same time, to take care to cleanse the condition of the ulcer and abscesses by proper topical applications or incisions.

I.—The accident resulting from the application of a ligature upon arteries, which has more especially interested the attention of practitioners, is *hemorrhage*; fortunately, the perfection which operative processes have attained makes this accident more rare now than it formerly was. It occurs more particularly when, in tying a trunk very near (fort rapproché) the heart, we have been obliged to place the ligature close up to a large collateral trunk; or when the ligature has been badly applied, or become displaced, or not been drawn sufficiently tight, or fixed upon a diseased portion of the vessel; or when, from any cause whatever, the vessel becomes diseased either above or even in some cases below the ligature.

Hemorrhage may also be produced by the rupture of the sac, and may occur after the first few days of, or not until a considerable time after, the operation, or it may depend upon the irritation which exists in the wound, or be only a simple exudation, (simple exhalation.) Without admitting that, in the process of Anel, it will occur in one out of every six cases, (as a surgeon in our times, by an erroneous statistical computation, has attempted to prove,) we must nevertheless concede that it happens sufficiently often to claim all the solicitude of practitioners. It is from the lower end of the artery that this most frequently takes place, and observations prove that it may thus occur on the seventh day as well as on the fifteenth, thirtieth or fortieth. Pressure, made upon the artery on

the side of the heart, or on the opposite side—compresses and lint, saturated with cold water, or impregnated with bonafoux powder, or the lotions of Binelli, Talrich and Halmagrand, or with any other hemostatic substance, applied upon the place from which the blood appears to issue, are the first means to be made use of. When they are not sufficient, we are obliged to remove the dressing and all the effused blood, and to have recourse to tamponing (tamponner) and indirect compression.

If these last measures should still prove insufficient, there will be nothing left to be done but to choose between the application of a ligature upon each of the two ends of the artery at the bottom of the wound, or at a point higher up on the limb. But, fortunately, we may in most cases dispense with proceeding to such extremities, and arrest the hemorrhage without recourse to a new operation.

[A *Hemorrhagic Diathesis* is to be taken into the account in all wounds of, or operations upon, the arteries. It would appear, from a case related by Dr. Alph. Guépratte, (*Journal des Connaiss.*, &c., Paris, Juin, 1844, p. 239, &c.) that the remarkable tendency, in some constitutions, to excessive hemorrhage upon receiving the slightest wounds or punctures, is not, as has been supposed, always *hereditary*, but sometimes acquired. This case was a West India boy, aged nine years, at Guadaloupe, of respectable, healthy, white parents. This disposition to hemorrhage is imputed, by M. Guépratte, to the defective nourishment afforded by the milk of the black nurse when the patient was a child, and his constantly persisting in living with her in a damp, unhealthy situation, and indulging in too much fruit. The patient was pale, emaciated, haggard, the superficial veins on the skin clearly visible and of violet color, and when the hemorrhage occurred, the blood was exceedingly attenuated, without scarcely any fibrine or red color—all of which appear to be naturally explained by the patient's course of life and the food used. A radical cure was effected, after some years, by change of residence, food, &c., time, tonics, meat, exercise, pure air, in order to give health and force and color to the blood, together with other judicious means.

We have, however, known this remarkable peculiarity to exist in three *children* of the same parents, not any of whom nor any of their relatives were ever known to have exhibited any indications of it. They were the grand-children of the present venerable Peleg Almy, Esq., of Portsmouth, Rhode Island—a family of the highest respectability, wealth and rank, and noted for their sound, healthy and robust constitutions—having, from the first settlement of New England, constantly resided on their patrimonial estates, from the year 1640 to the present time. Therefore, had such a predisposition been hereditary, it would certainly have been recorded. We have not the details of these cases, but they all died under the age of 16 years—one while an infant, from the physician having punctured a small abscess, while another bled to death from having knocked out a tooth in a fall. Mr. Almy informed me, (1844,) while I was at his residence, that these children had all been in the

enjoyment of excellent health, and that there was no circumstance within the knowledge of the family to account for the fatal results, either from hereditary or acquired causes.

There are, however, it must be recollected, hemorrhages which are of a *salutary or useful character* to the organization, carrying out the great law of the *vis medicatrix naturæ*. These do not require suppression by surgical means—in fact, should not be meddled with, except to control them when excessive. These hemorrhagic discharges are common in women, where there is dysmenorrhœa and obstruction to, or diminution in, the normal quantity of menstrual blood that ought to be evacuated. They take place as a vicarious efflux, but most usually synchronously with the catamenia, being more or less abundant as the latter are more or less restricted, or altogether absent. They come from the lungs, throat, nares, &c.; and a case is related by Professor D'Outrepont, (*Neue Zeitschrift Für Geburtskunde*; see also *Gaz. Méd de Paris*, Janv. 4, 1845, p. 13,) in which a similar discharge took place from near the insertion of the deltoid on the right arm; an incrustation of the size of an egg in diameter, which had formed there on the skin, falling off at each menstruation, and discharging freely of blood, which afforded great relief, and was either less or more in quantity, according to the quantity discharged from the genital parts. Similar discharges from the hemorrhoidal vessels are familiarly known at intervals of two months or more after the natural cessation of the menses; and I have known a case of an old man, who had a menstrual, hemorrhoidal flux of this kind, while his daughter invariably had a sanguineous discharge in the form of a passive hemorrhage, apparently from the branches of the bronchial arteries, and which she threw out by mouthfuls, without effort or pain, or paying any attention to it, as it always made up for any deficiency of the catamenia. So, as is familiarly known, these hemorrhoidal evacuations, so common in men also in the decline of life, become absolutely necessary to their existence when they live luxuriously, or are subject to more or less sanguineous plethora and congestion in the head, liver, chest, &c. All the peculiarities of constitution appertaining to a hemorrhagic diathesis, vicarious hemorrhages, &c., are to be duly weighed before and after operating for aneurism. T.]

§ VIII.—*Changes which are effected in the vessels of a limb after the obliteration of an artery.*

When an artery ceases to become permeable to the blood, there are certain changes produced in the neighborhood of the wounded part which it is proper to notice. Among these alterations, there are some that are generally conceded; others that are as yet questionable, or very imperfectly understood.

A. *Collateral Arteries*.—The blood, compelled to take another route in order to reach the lower part of the limb, enters the collaterals, by degrees dilates them, and soon produces anastomosing arcs of such large size, that branches which were scarcely visible in their natural state sometimes acquire the dimensions of a crow-quill,

while other branches, of a little larger volume, ultimately acquire a third of, or even half the size of, the primitive trunk. It is where such supplemental channels are readily formed, established, or developed, that operations for aneurism are attended with a prompt and successful issue, and that the pulsations, which had been momentarily suspended, soon reappear below the ligature. Though this point be universally conceded, it is not so on the question whether or not new arteries are created to re-establish the current of the blood after the division of the diseased trunk, (*tronc altéré.*)

B. *New arteries.* Parry (*An Experiment on the Art. puls.*, 1819) was one of the first who conjectured that new vessels were generated, a fact which he considers indisputable. He has seen, he says, the two ends of the carotid communicate with each other by numerous small vascular branches, a long time after it had been tied or divided. It was with difficulty at first that this statement was believed, in consequence of which his assertions did not attract as much attention as one would have supposed. At the same time, or a short time after, M. Ebel, a physician belonging to the military service, had arrived, according to M. Foerster, at results nearly similar, by means of experiments repeated upon more than thirty different animals. M. Salemi, M. Seiler, and M. Zuber obtained similar results. More recently, M. Schoensberg, (Christiani, *Journal des Progrès*, t. XII., p. 70,) has renewed the experiments of the English physician upon the carotid of goats and rams. He affirms that he has seen in these animals new branches of very considerable size, forming a very complicated net work between the two ends of the divided tube. If the delineation given by M. Foerster, (*Jour. des Progr.*, 1^e serie, t. XII.,) accurately represents what the Surgeon of Copenhagen professes to have ascertained, nothing can be conceived more beautiful than the process which the organization establishes under such circumstances.

It appears to me, however, that we are under an error in respect to the importance of this reproduction of vessels, and that it is a result also which we imagine to take place much more frequently than it in reality does. In contradiction to the facts related by M. Schoensberg, though it were even allowable to accord to them an entire faith, we may oppose the observations now almost without number, which have been made upon man. If new arteries reunited the two ends of that which had been divided, they would have been met with in the dead body in subjects who have died at the expiration of a greater or less period of time after the operation for aneurism; but never have the finest injections or the most careful and delicate dissections been enabled to demonstrate their existence. M. Mamoir (*Oper. cit.*, 1802, et *Thèse*, an XIII.) alone says he has found in a carotid which he had divided between two ligatures, a hollow filament (*filament creux*) going from the upper to the lower end of the artery. In place of this complicated net-work (*reseau*) spoken of by the authors whom I have quoted, I have found nothing but a cellular cord, pliant and impermeable to fluids,

and which blended imperceptibly with the cellular tissue of the neighborhood, but no new arteries to reestablish the continuity of the principal trunk.

If I do not deceive myself, the assertions of Parry, Bell, and MM. Meyer, (*Arch. Gén. de Méd.*, 1838, t. XIX., p. 567,) Foerster, Seiler, Zuber, and Schoensberg, are founded upon a phenomenon which has hitherto been but imperfectly examined, but which will readily furnish an explanation to the results which those authors imagine they have established. The albuminous effusion which takes place and coagulates (*se concrète*) about a ligature to form the virole of which M. Pecot speaks, (*vid. supra. vol. I.*) may, as has been remarked, become the seat, when it is organized, of a vascular net-work of new formation, in conformity to a very general law, observed in a great number of accidental organic productions; these small vessels which at first present themselves under the aspect of tortuous capillaries, or simple canals excavated in the midst of an amorphous substance, and in which the fluids and blood circulate rather under the influence of the laws of chemistry than by the impulsion of the heart, continue while the virole remains isolated and does not make part of the surrounding tissues; but as this growth (*renflement*) shrinks little by little, and gradually assumes the appearances and nature of cellular tissue properly so called, the small canals in question contract (*se reserrent*) in the same proportion, and ultimately in their turn present no longer any differences from the capillaries which pervade the lamellar system in general. These vessels being susceptible of distension, by injections, may be recognized and possess even a certain degree of magnitude during the first and second week after the operation, while at a period more advanced it will scarcely be possible to identify them any longer, as their purpose is not that of reestablishing the general circulation of the limb. Numerous experiments instituted by M. Manec, (*De la Ligature des Artères, &c.*, Paris, 1833,) have illustrated this fact, and seem to me confirmative of the opinion I have just given.

C. Remote Capillaries. (*Capillaires éloignés.*)—A result of the same kind but more important takes place, where the capillary branches of the upper collaterals communicate with the capillaries of the lower branches of the obliterated artery; circulating canals of every variety (*de toutes pièces*) are formed at this point, and what takes place is quite a different result from the mere dilatation of the natural capillaries. According to the experiments of MM. Kaltenbrunner, (*Exper. con. stat. sang.*, etc., 1826,) Wedmeyer, (*Jour. de Prog.*, 1e serie,) Doelinger, (*Ibid.*, t. IX.,) and Blainville, (*Cours de Physiol. compl.*, t. I.,) the arteries pour out the blood they contain into the amorphous or parenchymatous cellular tissue, before it is taken up (*repris*) by other vessels; in this organic woof (*trame*) the fluids oscillate rather than circulate, and act so to speak like water which has escaped and overflowed from a river, while excavating for itself a thousand channels, through a plain of sand; that is to say, that at every instant new conduits

are being formed, while others are disappearing. The blood not being enabled any longer to pass by its central primitive canal, creates for itself a number of passages, which afterwards become organized by degrees in order to transmit it from the upper into the lower portion of the closed vessel; and it is without doubt to this process that we must impute the heat, sensibility and even redness which manifest themselves under the skin in some patients, at the expiration of one, two or three days after the operation for aneurism.

[*Pathology of Aneurism.*—Dr. Thomas B. Peacock of Edinburgh in his post mortem examinations of aneurism of the ascending as well as arched portion of the aorta, is led to believe (Cormack's *Lond. and Edinb. Month. Jour. of Med. Sc.*, January, 1845, p. 16, &c.) with Dr. Hope (*Diseases of the Heart*, &c., 3d edition, 1839, p. 421,) that almost all of this description are originally of the true species. He has found that their dilatations and pouches, unless when very large and of long standing, all partook of the exact character of the general texture of the artery, the tunics being all readily separable by maceration, and each tunic when separated retaining its corresponding dilatation, while the continuity of the internal membrane with that of the sound portion of the tube was perfect. It rarely occurs, he says, in the larger tumors, that the internal tumors can be traced throughout the sacs, and it is extremely improbable, this physician says, as he had also shown by experiments on the formation of *dissecting aneurisms*, (*Lond. and Edinb. Month. Jour.* for October, 1843,) that Scarpa's idea can be correct, that the external coat of the aorta can alone sustain a column of blood extravasated between it and the middle tunic. A peculiarity of these aneurisms is their intercommunication through regularly formed apertures, between their sacs and the right ventricle of the heart, as was observed by Mr. Thurman, in eight out of ten of the interesting cases noticed by him in these situations, (see his *Memoir on aneurisms, and especially spontaneous varicose aneurisms of the ascending aorta and sinuses of Valsalva*—*Medico-chir. Transact.*, Vol. XXIII., 1840,) while in the two others the communication was with the right auricle. The greater frequency of communications with the right ventricle is owing to the situation of that cavity,—in close contact with the left and right sinuses of Valsalva, and the points of attachment of the corresponding valves—exposing it to the pressure of aneurisms in each of these situations, while the auricle is in contact with a much smaller portion of the origin of the aorta.

As illustrative of another remarkable peculiarity in the pathology of aneurism, or of what may be called perhaps, when the disease invades these primary trunks, the aneurismal diathesis, is the general *fatty degeneration* which takes place in the muscular tissues of the heart—which is generally found also to exist simultaneously in the liver and kidneys. Occasionally this fatty deposition will take place on the external surface of the heart and between it and the pericardium, with adhesion of the latter. In such cases Dr. Peacock

found the muscular coats of the heart attenuated. But in general it commences from within and proceeds outwardly.

RUPTURE OF THE HEART.

Rupture of the Heart and Ossification of the Veins of the Brain.—Dr. Claudi of Budweis (Germany) relates (Schmidt's *Jarbucher and Jour. des Connaiss.*, &c., Paris, Jan., 1844, p. 32) the case of a woman aged 56, robust and the mother of several children, who being suddenly seized with illness, fell and immediately expired. The largest veins of the pia mater were found of a whitish blue color as if distended with milk; they were indurated and in part ossified, especially near the sella turcica, where they exhibited here and there spindle-shaped dilatations. A circular cavity of the size of a small nut was found in the medullary substance above the right ventricle. The cortical substance on the anterior surface of the anterior lobe, exhibited an ulceration of 12 millimetres in length. The surface of the brain was every where covered with a layer of brownish and granular like matters. The pericardium was of a darkish blue, greatly distended and contained 12 to 1300 grammes of coagulated blood. The heart was fatty (adipeux) and at the lower part of the intra-ventricular septum there was a *zig-zag rupture* of 13 to 14 millimetres in length; and a little above that another to which clots of blood were adherent. The right ventricle contained nearly 15 grammes of blood; that of the left side was much larger. T.]

As closely connected with this subject we here insert a remarkable case of rupture of the heart, in the practice of Dr. Mott, many years ago:—

(*A Case of Sudden Death, from a Rupture of the Left Ventricle of the Heart, with Remarks, by Valentine Mott, M. D.* Trans. of the Physico-Medical Society of New York, vol. I., p. 150–160, year 1817.)

Instances of rupture of the heart, from violence or disease, are seldom met with in practice and less frequently recorded in medical writings. The following case of rupture of the parietes of the left ventricle, from an abscess, with a view of the parts, is respectfully presented to the society; as an interesting specimen of morbid anatomy.

The subject of this case, was a young woman, about twenty-two years of age; of a robust and plethoric habit. She had led an irregular and dissolute life; and from appearance and from what could be learnt, had been addicted to the liberal use of ardent spirits. For some time previous to her death, she had made no complaint which could be considered as amounting to indisposition. Her friends recollected to have heard her mention some slight pains, which she called rheumatism. They state, also, that she had entered into a marriage contract with a gentleman, who had broken it off a day or two before her death. Since which time, they say, she appeared dejected, and had been seen sobbing and in tears.

She took supper as usual, appeared somewhat dejected, and retired to bed at the ordinary time. As she remained longer in her chamber than common in the morning, some person was sent to awake her; but to the terror of the family she could not be roused—she was dead. From the posture in which she was found lying on the left side, with the knees drawn up, she was thought to be in a profound sleep; but, it was the sleep of death.

Examination and Dissection of the Body.

No marks of violence were to be seen on any part of the body. The lips were purple, one side of the face appeared also somewhat livid. The whole countenance, with the integuments of the neck, and upper part of the chest, were suffused with a deep red colour. The features of her face were not the least distorted; nor was there any apparent contortion of the limbs. It may be said that she slept through death; for she did not appear to have suffered any of its agonies.

The dissection was commenced by cutting through the parietes of the abdomen in the direction of the linea alba. The contents of this cavity upon a general inspection, appeared to be in a natural and healthy state, excepting the liver, which seemed larger than natural, and of a pale white color. In continuing the examination more particularly, the liver was the only viscus in this great cavity, which was found in an unhealthy state. It had contracted strong adhesions to the peritonæum where it lines the parietes of the chest, abdomen, and lower surface of the diaphragm. The connecting organized coagulable lymph, was very beautifully arranged, and appeared like small delicate shreds; some were an inch long, others of a greater length, and from one to two inches in width.

The thorax was next examined. On raising the sternum from the diaphragm, there was nothing preternatural to be seen. The lungs on each side were free from adhesions; but the pericardium was, to the feel, perhaps more tense than common. On opening the pericardium, a large coagulum of blood presented itself, covering the heart on all sides, and completely filling the cavity of the pericardium. This, when removed, amounted to eight or ten ounces, with an ounce or two of serum.

The heart was of the usual size and very fat. Upon lifting its apex, it was immediately discovered that the blood proceeded from an opening in the upper part of the left ventricle, about half an inch in diameter, of an irregular lacerated appearance. The parietes of the ventricle, around the opening, were considerably thinner than natural; and, upon attentive examination with the fingers, a fluctuation could be distinctly discovered, to the extent of an inch on one side of the opening; and upon pressure, flakes of a cheese-like substance were discharged.

The pericardium was generally of a natural appearance; excepting a portion of it, about the size of a dollar, or a little larger, opposite the opening, which showed strong marks of inflammation:

an adhesion, about the size of a six-pence, had also taken place a little above the opening, between it and the surface of the ventricle. The external surface of that part of the aorta, which is generally said to be within the pericardium, likewise exhibited, on one side, some traces of inflammation.

In order to give an opportunity for a more minute examination, the heart, pericardium, and large vessels about it, were taken out of the body. On opening the right auricle from the inferior cava, nothing unnatural was to be seen. The dissection was continued from the auricle into the right ventricle; and this also exhibited a natural appearance. The left auricle was next opened from one of the pulmonary veins, and then the left ventricle; both of which, in general, appeared natural. On more minute inspection, however, of the left ventricle, an opening of an elliptical form was discovered, sufficiently large to admit the little finger, about an inch from the origin of the aorta, on the left side, and immediately under the left columna carnea. It was considerably smaller than the external opening, to which it was almost directly opposite. Both openings communicated with an abscess in the parietes of the ventricle, about the size of a pigeon's egg. It was to the upper surface of the thin covering of this abscess, which was more prominent than other parts of the heart, that the pericardium was adhering.

The aortal, pulmonary, and ventricular valves, were all in a natural state.

From this case may be deduced, a very important fact in Pathology, though perhaps of little practical utility. It teaches us that considerable disease may exist in so essential an organ as the heart, and yet be unknown, or even unsuspected, from there not being a single symptom present by which it can be characterized. Authors and practitioners concur in opinion, as to the intricacy of most of the diseases of this highly important organ. In their commencement, they are so exceedingly obscure and insidious, that the most attentive and sagacious physicians are perplexed and embarrassed. Some are abruptly and suddenly fatal, as in the present instance; others, continuing for a considerable time, are mistaken for affections of some other part, but ultimately prove fatal. This is the general result of all diseases of the heart, as dissection confirms. Though the ravages of disease are extensive, there are often no predominant symptoms which can be considered as pathognomonic; the nature and seat of the diseases are guessed at, until an opportunity after death is afforded for dissection to develop them. Every fact which morbid anatomy furnishes, is important, as it tends to elucidate an obscure part of pathology, and must regulate our prognosis.

It is a curious and an interesting fact, that the left ventricle more frequently gives way, than any other part of the heart. At first sight, it appears strange, that the aortic or systemic side (which all anatomists know to be much stronger than the right or pulmonic side) should actually give way, or burst by its own action. This

fact is confirmed by the experience of the celebrated Portal, (*Cours d'Anatomie Medicale*), who informs us, that he has found the heart burst by its own action; the left more often than the right side; and the left ventricle more frequently than the auricle.

Verbrugge, in his *Dissertation on Aneurism*, makes a similar remark, that though the left ventricle, from its organization, might be considered less subject to rupture, it is however the most frequent seat of it. Morgagni also mentions one or two facts of a similar nature. Professor Chaussier communicated to Portal, a case of rupture of the left auricle from a carriage wheel passing over the arch of the aorta.

When organic lesion of the heart occurs, in the sound state, it has most generally been induced by some violent and sudden effort, or by a burst of anger. We see an analogous effect produced upon other powerful muscles of the body, and particularly the strong fibres of the gastrocnemius which are lacerated by their own strong and sudden contractions.

The present case cannot be considered a fair specimen of organic lesion of the heart, in a sound state; but an example of abscess or ulceration in the parietes of the left ventricle, which, upon bursting, proved suddenly fatal. The habit of our patient, no doubt, very much accelerated the fatal termination, "for we uniformly find, (says the late much lamented Allan Burns,) that in almost every organic lesion of the heart, stimuli are the bane of the patient." As extreme grief has been anciently said to break the heart, the disappointment in love which this unfortunate young woman experienced, ought not perhaps to be wholly overlooked in an investigation of the cause of her fatal disease.

The existence of rupture of the heart, where the muscular parietes have been diseased, is additionally confirmed by this case. In most of the examples, it would appear, that hectic, and other symptoms of decay, have been the attendants. This appears to have been the condition of a man whose case is related by Marchettis. This patient, after lingering for some time, died suddenly, and dissection showed an ulcer, which had destroyed, not only the pericardium, but also a large portion of the heart; and the ulceration had ultimately penetrated into the left ventricle, and sudden death was the consequence. Other observers have recorded similar cases. (Morgagni.) Morgagni found on dissection, in a spleeny old man, who died on the third day after a slight indisposition, that blood was effused into the cavity of the pericardium, through three holes, which communicated with the left ventricle.

Organic lesions of the heart, and spontaneous rupture, from abscess, or ulceration, or the bursting of an aneurism of the aorta within the pericardium,* are uniformly and quickly fatal. In each

* Whilst a pupil in Guy's Hospital (London) I saw an instance of instantaneous death, from the rupture of an aneurism of the aorta, within the pericardium, about the size of half a nutmeg. The man was on the operating table, undergoing the operation for popliteal aneurism; and just as A. Cooper was about to raise the lower edge of the sartorius muscle, he suddenly expired.

of these instances, the pericardium becomes filled with blood, and the heart is oppressed, and no longer able to act. Perforations of the heart from wounds, are observed to be less suddenly mortal than the lacerations just referred to. We are informed by Fanton, that he saw a man live till the twenty-third day, who had been wounded in the heart. The left ventricle was pierced, and, as he states, the internal fibres corroded and destroyed. Though but few will be willing to give credit to a case so astonishing, we have, nevertheless, a number of very remarkable examples of wounds of the heart, by Morgagni and others, where it has been pierced through and through, without being followed by instant death. Charles Bell has seen a man who was wounded during the embarkation of Sir John Moore's army at Corunna, in whom the right ventricle of the heart was penetrated by a ball; and he lived for fourteen days. In the 2d vol. of the *Medico-Chirurgical Transactions*, we find a case related, in which a bayonet had wounded the heart. It extended about three quarters of an inch into the muscular substance of the left ventricle, about two inches from the apex. The bayonet penetrated the substance of the ventricle, and divided one of the fleshy columns of the mitral valve. This man lived forty-nine hours after receiving the injury. He expired suddenly in the night, experiencing just before his death, a chilly sensation, which admonished him of his approaching dissolution.

EXPLANATION OF THE PLATES.

FIGURE 1st. Represents the heart unopened: the whole extent of the left Ventricle is seen; at the upper part of which is the hole, or rupture, and the diseased appearance around it. Likewise the pericardium adhering a little above and reflected back to show the diseased part more completely.

1. The left ventricle unopened.
2. The hole or rupture, large enough to admit the end of the little finger.
3. Diseased part, showing a prominence of the abscess, and a dark coloured inflammation surrounding it: at this point the fluctuation was plainly to be felt.
4. A portion of the pericardium folded and thrown back.
5. Point of adhesion with the ventricle.
6. Left auricle.
7. Pulmonary artery.
- 8-8. Division of the pulmonary artery into right and left.
9. Ascending aorta.
10. Superior cava.

FIGURE 2d. Shows the left Ventricle cut open through the middle, and reflected back to expose the internal opening through which a bougie is passed.

1. The aorta.
2. Pulmonary artery.
- 3-3. Right and left pulmonary arteries.
4. Superior cava.
5. Divided edge of the left ventricle as turned up.
6. Lower edge of the same with the external surface of the ventricle.
7. One of the mitral valves.
- 8-8. Cordæ tendineæ.
- 9-9. Divided edges of the left columna carnea.
- a. The internal pectinated surface of the left ventricle.
- b. Internal opening with a bougie introduced.

RUPTURE OF THE HEART.



SECTION V.

ARTERIES IN PARTICULAR.

CHAPTER I.

ARTERIES OF THE ABDOMINAL LIMB.

THE arteries of the lower extremity being exposed more than any where else to the action of external agents, and being at the same time numerous, and for the most part of considerable magnitude, are naturally subject and more liable in fact than any others to all the diseases of the arterial system. The surgeon therefore is frequently called upon to perform serious operations upon this member; nevertheless the trunks and their principal branches are the only ones upon which these operations can be practised with advantage; consequently there are scarcely any others in this point of view that ever require our attention, except the dorsalis pedis, anterior tibial, posterior tibial, peroneal, popliteal, and femoral, and the circumflex and iliac arteries.

ARTICLE I.—THE DORSALIS PEDIS.

§ I.—*Anatomy.*

The Dorsalis Pedis artery, being a mere continuation of the anterior tibial, takes its origin under the annular ligament of the tarsus, a little nearer to the internal than the external malleolus; thence it passes obliquely inwards towards the first inter-osseous space of the metatarsus, which it traverses from above downwards, to reach the plantar surface of the foot, and to form the plantar arch, in anastomosing with the external branch of the posterior tibial. Separated from the bones and from their ligaments by a simple cellulo-adipose layer, and accompanied (*côtoyée*) on the inner side, sometimes on the outer, by the internal branch of the deep dorsal nerve of the foot, and by its accompanying vein on the opposite side, this artery is covered as we proceed from the deep-seated parts towards the skin: 1st, by a thin fibro-cellular lamella which separates it from the surrounding tendons; 2nd, by a cellulo-adipose layer which is not constant; 3rd, by the dorsal aponeurosis of the foot; 4th, by the sub-cutaneous fascia, upon which moreover are distributed the superficial dorsal veins and nerves; and 5th, by the skin. The first tendon of the extensor longus digitorum pedis, is found upon its outer side; that of the extensor proprius pollicis pedis, upon

its inner side, while the first bundle of the extensor brevis digitorum pedis muscle crosses it very obliquely from without inwards, and from behind forwards, on its anterior portion.

Though the tarsal and metatarsal branches which the dorsalis pedis artery furnishes, may be of too little importance to require any description here, it is quite otherwise with its *anomalies*: I have once met with it directly under the skin; but it happens more frequently that it is entirely wanting; and a branch of the fibular artery sometimes takes its place; at other times it is replaced by a very large branch of the posterior tibial. Though it be true that these varieties are of a nature to cause much embarrassment to young surgeons who practise on the dead subject, I do not see how this can be so on the living body. In fact if the vessel does not exist, no lesion can make it necessary to look for it; if it is given off by the posterior arteries of the leg, its position at one of the borders of the foot, supposing it becomes necessary to tie it in consequence of a wound, will preclude the idea of our searching for it in its customary situation.

§ II.—*Indications.*

Boyer asks the question if an aneurism of the dorsalis pedis artery has ever been seen. Neither Pelletan, Scarpa, nor Dupuytren appear to have met with it; from whence we may conclude that it is at least very rare. Nevertheless, Guattani says he has seen an example of this kind caused by venesection, (*une saignée*,) and M. Roux mentions two cases of wounds of this artery, which were the source of alarming hemorrhages. M. Vidal has published in the *Clinique*, a similar case observed in the Hospital of Beaujon. M. Champion informs me of another, and the only one perhaps in which there has been a false consecutive aneurism of this artery. It is evident moreover, if such a thing should be met with, that the compression which succeeded in the case of M. Champion, would generally answer, and that if we operated according to the modern method, it would be the anterior tibial and not the dorsalis pedis, which it would be necessary to tie; [See note of Dr. Mott, above,] but as it may be required to obliterate the vessel in front and behind the lesion, in consequence of the plantar arch, that is, to operate after the ancient method, the surgeon ought consequently to know where to find the artery itself.

§ III.—*Operative Process.*

The patient should be laid upon a bed, with the limb slightly flexed and the foot moderately extended; an assistant holds the limb steady by grasping it above the ankle-bones. With a straight or convex bistoury, the surgeon makes an incision into the skin of about two inches, in the direction of an oblique line carried from the middle of the instep to the first inter-osseous space; and divides the sub-cutaneous layer, while he endeavours to avoid the principal

venous and nervous branches which it contains ; he then comes down in succession to the aponeurosis, then between the tendons of the two first toes, then upon the second fibrous layer, and finally upon the artery itself, which he isolates by means of a grooved sound from the veins and from the collateral nerve and cellular tissue, before applying the ligature, which he ties, after having perfectly assured himself that he has included nothing in it but the artery. Two strips of adhesive plaster bring the lips of the wound together, and the operation is terminated.

ARTICLE II.—ANTERIOR TIBIAL ARTERY.

§ I.—*Anatomy.*

The anterior tibial artery, after taking its rise from the popliteal, and after having pierced almost at a right angle the upper part of the inter-osseous ligament, follows as it descends to the middle of the instep, the direction of an oblique line drawn from the middle of the space between the head of the fibula and the spine of the tibia. Resting almost denuded upon the inter-osseous ligament in its two upper thirds, then upon the outer side and front part of the tibia ; it is consequently situated at so much the greater depth, the higher up we seek for it upon the leg. The two veins which accompany it repeatedly communicate with each other in front of the artery by small transverse branches ; the nerve of the same name crosses its anterior surface very obliquely from above downwards, and from without inwards ; sometimes however it continues outside as far down as the instep. A thin (peu abondant) pliant cellular tissue, envelopes and unites these different parts, but does not furnish them a true sheath. The anterior tibial being situated between the extensor longus digitorum pedis, and tibialis anticus muscles above, and the tibialis anticus, and extensor proprius pollicis pedis in the middle portion, and the extensor proprius pollicis pedis, and the extensor longus digitorum pedis far below, but rarely presents anomalies of sufficient importance to require the attention of the surgeon ; nor are the branches that proceed from it with the exception of the anterior tibial recurrent, of any importance in surgical operations.

Anomalies. I have twice seen the anterior tibial artery lying superficial at the middle of the leg. In one of these cases it originated as usual from the popliteal. In the other, in the place of piercing the inter-osseous ligament, it turned around outside of the fibula and followed the course of the musculo-cutaneous nerve. It is to one of these peculiarities that we ought doubtless to attribute the pulsations observed on the fore-part of the legs in a patient of Pelletan's, (*Clin. Chir.*, t. II.) and which misled this practitioner so far as almost to induce him to believe in the existence of an aneurism. Fortunately we have only to recal the possibility of such an anomaly, to understand how we are to avoid the mistakes or errors that might arise from it.

§ II.—*Indications*

Supported by the inter-osseous ligament behind, by the bones of the leg upon its sides, and by muscles in front, which are firmly held down by a strong aponeurosis, the anterior tibial must rarely be the seat of a *spontaneous aneurism*. For myself, I do not know a single instance of it, unless we may regard as such the case of a bloody tumor described by Pelletan, which had destroyed by erosion a great portion of the upper extremity of the tibia. *Traumatic aneurisms* on the other hand, are observed here quite frequently; these which are sometimes circumscribed, but more frequently diffused, are produced by pointed and cutting instruments, balls and all sorts of projectiles, fragments of bones in fractures, &c. J. L. Petit, (*Malad. des Os*, t. II., p. 46.) Desault, (*Œuvres Chir.*, t. II.,) Deschamps, (*Journal de Fourcroy*, t. III., p. 85.) Dupuytren, (*Repert. d'Anat. et de Phys.*, &c., t. V., p. 217,) Pelletan, (*Clin. Chir.*, t. II., p. 266,) Boyer, MM. Roux, (*Méd. Oper.*, t. I.,) and Cowan, (*The Lancet*, 1829, Vol. I., p. 719,) relate examples of them, and show that they may occur at all the different points (hauteurs) of the leg.

Deschamps in the case mentioned by him of *false consecutive aneurism*, operated by the ancient method. This also is the method which M. Guthrie exclusively adopts in such cases. If the blood should still be flowing, if the accident should have existed only for a short time, and the wound of the artery appear easy of access we might, and ought in fact, to adopt the course of these two authors; but otherwise the method of Anel is preferable. It does not appear at all necessary to place a second ligature under the tumor or wound, as some surgeons have recommended, inasmuch as a moderate degree of compression will answer that purpose advantageously.

If however, the disease should be situated in the upper third of the leg it would be difficult to *tie the artery above*, without encountering the tumor, and consequently we should not have it in our power to avoid adopting the ancient method. In that and in all cases where it would be attended with too much difficulty to perform the operation on the leg, there remains as a last resource, the ligature upon the popliteal or the femoral itself. Dupuytren first employed this practice with success in 1809, in conformity to the recommendation of Pelletan, (*Clin. Chir.*, t. I., p. 178,) upon a woman aged sixty years, who was brought to the Hotel Dieu, with a fracture complicated with a diffused aneurism of considerable size in the leg. M. Roux derived the same advantage from it in a case of hemorrhage following amputation below the knee, and Delpech has frequently obtained similar fortunate results. M. Guthrie however (*Injuries of Arteries*, &c., p. 283,) who avers that he has seen this operation performed at Albufera and Salamanca, long before our countrymen thought of it, condemns it in most energetic terms. In a soldier operated upon in May 1814, the hemorrhage returned to

the wound : it became necessary to amputate and the patient died. The same thing took place in another soldier wounded at Salamanca. According to M. Guthrie it is infinitely better to lay open the tissues freely at the risk of dividing the muscles ; here is a proof of it : a young man let the point of a sabre fall upon the fore-part of the leg and wounded the anterior tibial artery. A false circumscribed aneurism was formed. M. Josse, (*Mélanges de Chir.*, p. 247,) ties the femoral artery ; the ligature comes away ; hemorrhages take place ; the pulsations in the tumor are uninterrupted. The operation by the ancient method is performed, and the patient recovers. Though it may be true as a general rule that the operation by the ancient method is more certain, Sommé (*Jour. Hebdom. Univ.*, t. II., p. 242,) has shown, and M. Nève, (*Communiqué par M. Champion*, 1838,) of Bar-le-duc, has also recently proved that the advice of Dupuytren may be followed with advantage.

§ III.—Operative Process.

The patient placed as for the dorsalis pedis ought to have the leg in slight pronation, and arranged in such manner that the muscles of its anterior portion may be stretched or relaxed at pleasure by the assistant when he acts on the foot. To arrive upon the artery it is necessary to divide the skin, the subcutaneous layer and the aponeurosis, to the extent of about two inches upon the line mentioned above ; then with the fore-finger or the extremity of a grooved sound, we separate if we are above the extensor longus pollicis pedis from the tibialis anticus, pushing it outwards ; and from the extensor longus digitorum pedis, on the contrary, and pushing the latter inwards, if we are far below. This being done, there is nothing left but to isolate the artery from its accompanying veins and collateral nerve, in order to tie it, then to unite the lips of the wound and apply a suitable bandage.

In its *middle part*, or its two upper thirds the artery may be cut down upon in many different ways.

A. Process of M. Lisfranc.—In the process attributed to M. Lisfranc, by MM. Coster (*Manuel des Op.* etc., 3e edit.,) and Taxil, (*Thèse* No. 142, Paris, 1822,) the incision of the skin is oblique from below upwards, from the crest of the tibia towards the fibula, and distant about an inch or two from the horizontal line. After having divided the aponeurosis transversely, we seek for the interstice which separates the tibialis anticus from the extensors, and as it is the first we meet with outside the tibia, nothing is more easy than to distinguish it.

B. The Ordinary Process.—In the common process we cut parallel to the direction of and upon the track of the artery, taking for our guide the line mentioned above, or the middle of the space which separates the fibula from the crest of the tibia ; or the slight depression which naturally exists opposite to the interval of the muscles that we intend to separate apart (*écarter*,) or what in fact is as well we carry the bistoury directly to about an inch outside the anterior

border of the leg ; the aponeurosis like the skin should be divided to the extent of three to four inches ; the muscular interstice where we should use the fore-finger, in order to separate the muscles and to come perpendicularly upon the inter-osseous ligament, is indicated by a yellowish line. At the bottom of this interstice is seen the vessel which we endeavour to isolate and raise up, but this is the most difficult part of the operation.

C. After having *flexed the foot* and properly separated the muscles apart, the best mode of managing with the artery is to pass under it a grooved sound, very obliquely from below upwards and from the fibula towards the tibia, in place of passing it transversely or from the anterior to the outer border of the leg. To appreciate the utility of this remark, we have only to recal to mind, that the fibula is almost always on the same plane with that of the vessels, while the crest of the tibia is much above their level. We may moreover apply the ligature by means of the needle of Deschamps, or any other of the numerous *porte-ligatures* [ligature-holders, i. e., with handles to hold the needles. T.] which have been contrived for this purpose.

D. *Appreciation*.—It is needless to remark that no one will venture at the present time to imitate Hey (Ester dans Bell., trad., Franç., p. 205,) or Logan, (Hey's *Practical Observations*, 1814,) by cutting out a portion of the fibula to arrive with more ease upon the tibial artery, as these Surgeons declare they have once done with success, and as Gooch (Bell, *Op. cit.*, p. 199,) has the boldness to recommend. The oblique incision, it is asserted, enables us to come down with more ease than the parallel incision, upon the guiding interstice (interstice directeur) and the trunk of the artery. The remark is true for the first point, but not for the second, and experiments frequently repeated show that we should give the preference to the ancient method at least in ordinary cases, and whenever there are no special indications to fulfil.

ARTICLE III.—POSTERIOR TIBIAL ARTERY.

§ I.—*Anatomy*.

From its origin a little below the popliteus muscle down to its division into the internal and external plantars, the posterior tibial artery follows almost exactly the direction of a line very little convex inwardly, which would extend from the middle of the upper part, (*racine*) of the calf, to half an inch behind the internal malleolus. Two veins of considerable size ordinarily accompany it, and by their frequent anastomoses sometimes form around it a complete network. Upon its fibular side is found the posterior tibial nerve which is rarely distant from it more than three or four lines. Supported throughout its whole extent by deep seated muscles, it is covered over by the aponeurosis which is situated between the two fleshy layers of this region ; also by muscles, or cellular tissue, and other fibrous lamellæ,

afterwards by the common integuments, but with peculiarities in certain parts of its track which it is important to note.

A. *In the Tibio-calcanean Groove*, (la gouttière tibio-calcaneienne,) the posterior tibial artery rests against the fibrous sheath of the flexor longus digitorum pedis, at about three lines from the posterior border of the malleolus; the nerve is behind and the veins are on the inside; a lamellar or adipose tissue envelops it; the internal ligament of the tarsus, a kind of fibrous layer which is continuous with the aponeurosis of the leg covers the artery and binds it down (la bride) where this ligament blends with the dense and filamentous tissue which separates it from the skin.

B. *Between the Malleolus and the termination of the calf*, the posterior tibial artery is a little farther distant from the tibia. The nerve is rather outside than behind. The lamellæ which immediately surround it are very pliant, and frequently covered with fat. The deep aponeurosis which is quite thin in this place, holds it firm, (la tient appliquée) against the tibialis posticus muscle, the flexor longus digitorum pedis, and the flexor longus pollicis pedis; outside of this lamella is seen the tissue which forms (remplit) the sheath of the tendo Achillis, then the tibial aponeurosis properly so called, before we arrive at the skin.

C. *At the Calf*, the tibial artery is situated very deep, and almost on the same plane with the posterior surface, and much nearer to the external or fibular than to the internal border of the bone which has given its name to it. The aponeurosis which covers it and which in some sort it lies in naked contact with, and which is ribbon-like in appearance, (rubanné) and silvery (argentine) with longitudinal and very strong fibres is concealed by the tibial portion of the soleus muscle, the gastrocnemius internus, the tibial aponeurosis (aponéurose jambière,) and the sub-cutaneous tissue, in which are found situated the great saphena vein and the internal saphena nerve.

D. It is an unusual thing to find the *posterior tibial artery wanting*, but it may happen that it is of very small size, and that the fibular artery takes its place on the surface of the foot. More frequently it continues upon the median line until it reaches near the malleolus; in that case, (alors,) the nerve is on its inner border. I have on one occasion seen it proceed along side of the fibular artery for two thirds of its extent, and pass under the arch of the os calcis at near an inch behind the malleolus.

§ II.—*Indications.*

Like the anterior tibial, and for the same reasons, the posterior tibial artery is very rarely the seat of spontaneous aneurisms, or even of false circumscribed aneurisms; Ruysch, nevertheless, cites a case of aneurism near the heel, which could only belong to this artery, and which was opened by mistake for an abscess. M. Dorsey (*Elements of Surgery*, Vol. II., p. 271,) gives an example of varicose dilatation and hypertrophy of this artery in a case of aneurismal varix. Guattani also speaks of pulsating tumors, which,

without doubt, were the result of certain lesions of the posterior tibial. Wounds, in fact, accompanied with hemorrhages or diffused aneurisms, have in latter times been noticed in this artery, by Scarpa, Dupuytren, MM. Hodgson, Marjolin, Earle, and Vincent. (*The Lancet*, 1829, Vol. I., p. 719.)

The *ancient method*, according to Boyer, is the only one which should be applied to these affections, since, by the method of Anel, the blood would soon be brought back to the inferior end, by means of the plantar arch and the anterior tibial. Others, influenced by the same fears, but not wishing to act upon the diseased point, have proposed an intermediate method; that is, to place one ligature above and one below the aneurism, without touching the tumor. I confess I do not see the necessity of proceeding in this manner. On the supposition that the return of the blood would be an obstacle to the cure, as in the patient of Alancon, (*Man. Prat. de l'Amput.*, p. 164,) all that would be necessary probably to prevent it would be to make methodical compression upon the course of the dorsalis pedis artery, as M. Marjolin has done, or even below (that is, on the distal side of) the wound, if its position permitted. On the other hand, when the seat of the difficulty is in the sole of the foot, and compression does not succeed, the ligature upon the trunk of the tibial evidently cannot be applied, except by the modern method. The only case where the ancient operation might strictly be admissible, or at least be preferable, if we should not be inclined to tie the popliteal or femoral artery, is that where the aneurism occupies the upper half of the leg.

Nevertheless, diffused traumatic aneurisms do not come under this rule, and should I think be treated as Boyer and M. Guthrie recommended; that is, by the method of Keyseire. Though Pelletan, (*Clin. Chir.*, t. II., p. 266,) unable to tie a wounded posterior tibial, succeeded by an incision and by tamponing, (*tamponnant*,) and by compressing the artery upon the inter-osseous ligament; and Colomb, already quoted, confined himself to simple compression in a case of this kind; and though Gelée put a stop to the hemorrhage, by cutting down and introducing a thread in order to pass a piece of agaric against the artery, we see that compression was followed by gangrene in the cases of Bourienne, (*Journal de Horn*, t. VII., p. 281—282,) by convulsions and death in two patients that Boyer speaks of, (*Malad. Chir.*, t. I., p. 262,) and proved ineffectual in the cases of Wiseman, Deschamps, Briot, and a great number of other surgeons. The ligature which was placed upon the anterior tibial artery by Giniés, (*Anc. Journ. de Méd.*, t. LXXVI., p. 71,) and on one of the other arteries of the leg by M. Ouvrard, (*Obs. de Méd. et de Chir.*, 1828, p. 245,) had entire success, and is therefore in every respect to be preferred.

§ III.—Operative Process.

Whatever may be the point where we wish to lay bare the posterior tibial artery, the leg should be flexed and laid upon its ex-

ternal side; and in the same way as for the anterior tibial, if compression is to be made, it is to be made upon the thigh or upon the body of the pubis.

A. *Behind the Malleolus.*

a. Process of the Author.—I make an incision slightly curved, with its concavity forwards, which, commencing an inch above, finishes an inch below, and passes at three or four lines behind the posterior border of this projection. When we arrive at the beginning of the groove of the os calcis, it is of importance to proceed with caution, and to cut the tissues layer by layer, and pass the grooved sound under the aponeurosis, before dividing it with the bistoury, if we do not wish to incur the risk of wounding the artery, which is sometimes very superficial; in making the incision nearer the malleolus, we might readily penetrate into one of the fibro-synovial grooves which it assists in forming, and nothing would be more dangerous than such a mistake, because of the inflammation which might result from it. Farther back, the artery would be difficult to find, and the operation much more laborious.

b. Process of M. Robert.—M. Robert proceeds in another manner. Here is the method which he has communicated to me: The incision extending and directed from the posterior angle of the malleolus to the upper border of the os calcis, should be perpendicular to the course of the vessel. "Thus placed, it enables us," says M. Robert, "to isolate the artery without difficulty, as soon as the aponeurosis, which is very thick in this place, has been divided."

In a case of a recent opening into the tibial artery in this region, M. H. Berard, (*Arch. Gén. de Méd.*, 2e series, t. VII., p. 453,) having secured its two ends, found that the hemorrhage continued, but that it proceeded from a vein which it was unnecessary to tie.

B. *Below the Calf,*

I make a straight incision, from two to three inches long, at an equal distance from the inner border of the tibia and the tendo Achillis. The skin, the adipose tissue, and the superficial layer (feuillet) of the aponeurosis having been divided, we endeavor, by means of the sound, to denude the deep-seated aponeurosis; and then divide this tissue to the same extent as the skin, being careful always to guide the bistoury upon the groove of a director. In that case, we are certain to encounter the artery, especially when we have taken the precaution to divide the tissues perpendicularly; that is to say, by carrying the bistoury from behind forwards, and from the inner towards the outer border of the leg, as though we were going to prolong it to the fibular side of the tibia. It is important to recollect, that if the integuments are attacked nearer the bone than the place mentioned, we should have but one instead of two aponeurotic layers to divide; but that, in thus coming down upon the muscles at a great distance from the vessel, we should run a much greater risk of being led astray, than by proceeding in the manner I have indicated.

C. *In the thick part of the Leg, (au gras de la Jambe.)*

M. Guthrie, on one occasion, undertook to cut down upon the posterior tibial, by cutting through the whole thickness of the calf. Gelée, in the case described by him, made a counter opening, passed a ligature between the two muscular layers, and then tied it upon compresses on the front part of the limb, after having inserted into the depth of the wound several pieces of linen between the muscles and the artery, in order to act upon this last with a sufficient degree of pressure: his patient recovered.

b. Most authors, on the contrary, recommend that we should penetrate on the inner side of the leg, and dissect and turn back the corresponding portion of the soleus muscle from the posterior surface of the tibia. But then the operator would run the risk of denuding the bone, of not reaching the vessels without much difficulty, and of meeting with such interference from the muscles as to oblige him, after the operation, to divide their fibres transversely upon the posterior lip of the wound, as happened to M. Bouchet, of Lyon. In proceeding in the following manner, we are protected from all such inconveniences.

c. *The Author.*—Placed on the outside of the limb, the surgeon makes an incision of about four inches long, in the direction, and at the distance of, considerably more than the width of a finger from the inner border of the tibia, then separates the saphena vein, divides the aponeurosis, and falls perpendicularly upon the fibres of the soleus muscle, which he divides, layer by layer, as though he were cutting for the posterior surface of the tibia very near its outer border; in a short time he perceives a fibrous, thick, pearl-colored layer, upon which the muscular fibres are inserted; this is the deep aponeurosis which is traversed by many vascular branches. We divide it upon a grooved sound to a sufficient extent, and the artery being situated immediately above, and surrounded by its satellite veins and accompanied by the nerve which is distinguishable from it by its rounded form, size, and yellow color, is then easily raised up and tied.

ARTICLE IV.—THE FIBULAR ARTERY.

It is seldom, except at its upper portion, that the fibular artery can require the interposition of operative surgery. Below it is too small and too deep-seated to make it necessary to pay any regard to its wounds. On the supposition that aneurisms might be developed on some part of its track, an example of which was seen in the Hotel Dieu in 1830, sound practice perhaps would suggest that we should proceed to tie the popliteal or the femoral, rather than the diseased trunk itself. If, however, we should, owing to any particular circumstance, feel ourselves obliged to pursue a contrary course, as occurred to Ouvrard, (*Oper. Citat.*, p. 251,) the following is the process which it would be necessary to adopt:—

§ I.—*Operative Process.*

Since it would be necessary, if in the calf, to look for the fibular artery at the depth of several inches, whether we adopted the process of M. Guthrie or proceeded according to the rules indicated for the posterior tibial; and inasmuch as it is a vessel of no importance in its lower fourth, there is no other point in fact where it is allowable to attempt to tie it, except at the place where the soleus is separated from the gastrocnemii. A wound three inches long, parallel with the posterior border of the fibula, and inclined towards the axis of the limb, and comprising the skin, adipose tissue, superficial aponeurosis, the outer root (racine) of the soleus, and the deep-seated aponeurosis, would in fact put it in our power to lay it bare, and to isolate it in the midst of the fibres, or upon the posterior and inner side of the flexor longus pollicis pedis. M. Guthrie, (*Oper. Cit.*, p. 298,) who is a declared enemy of the method of Anel in traumatic aneurisms, preferred, in order to reach this vessel in a case in which it had been wounded by a ball, to cut into the calf vertically to the extent of seven inches; then to divide transversely the outer border of the wound, and afterwards to constrict the artery indirectly by means of a ligature introduced in a suture needle, rather than lay it bare above. We should in fact, in my opinion, in a case of this kind, follow his mode rather than decide upon tying the trunk of the femoral.

§ II.

The rule which recommends that for all these ligatures the incision through the integuments *should cross the track of the artery* at an angle of thirty-five degrees, instead of being made parallel to it, might without doubt be adopted, and in fact should not, perhaps, in some cases be disregarded; but in the majority of cases it does not appear to me to possess such advantages over the ordinary method, as to require any special recommendation.

ARTICLE V.—THE POPLITEAL ARTERY.

§ I.—*Anatomy.*

The ham, which has acquired importance in surgery for a century past, in consequence of its principal artery, is a hollow of a rhomboidal form, (*en forme de losange*,) composed of two triangles united at their base, and having its broadest part situated above the condyles of the femur.

A. The *popliteal artery* courses through it from above downwards, keeping a little nearer to its inner border, which conceals the vessel at its origin, than to its outer border, until it reaches the point where it enters into the notch between the condyles. In its

femoral portion, the vein is closely united to it upon its posterior and outer side; the internal branch of the sciatic nerve is still more superficial; from three to five lymphatic ganglions and cellular and adipose tissue surround it, and separate the whole of this portion of it from the aponeurosis. In the leg it is not so deeply situated; quite frequently the vein and nerve are found on the inner side of it; at other times the first is found upon its fibular aspect, while the second is placed upon its tibial side. On its posterior surface it is concealed, first by adipose cellular tissue, and afterwards, a little farther down, by the origin of the gastrocnemii, while its anterior surface rests against the posterior ligament of the articulation and the popliteal muscle. This artery, moreover, has been wounded by a necrosed fragment of the tibia in a patient whose case is mentioned by M. Porter, (*Journ. des Conn. Méd. Chir.*, t. I., p. 27.) It is proper to add that the external saphena vein is no longer superficial after it enters into this region, and where it is generally found upon the median line; and that, after having received from the thigh its descending branch, it empties into the popliteal vein a little above the condyles. In a specimen which M. Manec exhibited to me, it was given off by the ischiatic artery, but was wanting in the case mentioned by M. Caillard, (*Thèse No. 307, Paris, 1833.*) The five articular arteries, and the two surales which arise from it, serve to re-establish the circulation of the leg and thigh in cases of aneurism of the ham.

§ II.—Mechanism.

In no part are aneurisms more common than in the ham. Spontaneous aneurism is that which is more especially met with here; traumatic aneurism is not unfrequent; varicose aneurism (*aneurisme variqueux*) has also been sometimes met with in this artery, (J. Terry, *Encyclograph. Méd.*, 1836, p. 100. Larrey de Toulouse, *Press. Méd.*, t. I., p. 25. Lassus, *Pathol. Chir.* Ribes, *Bullet. de la Faculté*, t. V., p. 284.) The great frequency of the first has specially occupied the attention of surgeons; some have imputed it to the efforts of extension of the leg upon the thigh; Scarpa and Delpech have taken ground against this opinion, by maintaining that an aneurism, which is not directly occasioned by a wound, is always produced by a disease of the internal or middle coats of the artery. M. Richerand considered the first opinion conclusively established; but M. Hodgson speaks of facts which have given opposite results, and the majority of the moderns adopt the opinion of Scarpa. May it not be possible to reconcile these two modes of treating this question? While the artery continues perfectly sound, no extension of the leg, it is true, appears capable of rupturing its coats; but if its interior is encrusted with calcareous plates, (plaques,) or is the seat of any ulceration; if one of its coats (membranes) has lost its flexibility and become brittle, how can we reject the cause assigned by the ancients? It is certain that laboring men and those who are habitually in the erect posture;

postilions, (jockeys) for example, are those who are most frequently the subjects of this disease.

The form and the accidents of popliteal aneurism, and everything that concerns its development, find a natural explanation in the anatomical arrangement above-mentioned. Restricted by the bones in front, and the aponeurosis behind, the tumor first increases in breadth, or from above downwards, and remains a long time before it makes any prominence outwardly. Most frequently, however, the aponeurosis yields, and soon after becomes attenuated, so that the aneurism ultimately makes a projection under the skin. Anatomy also teaches us that we must not judge of the seat of the arterial opening by the position which the tumor occupies outwardly. The resistance presented by the soft parts of the popliteal region being less in its middle portion than anywhere else, is the reason why the sac always has a tendency to make its way towards that part. This, moreover, is a peculiarity which we must not lose sight of when we decide upon operating by the ancient method.

§ III.—*Circulation.*

The anastomoses which enable the arteries of the leg to communicate with each other, are too numerous and too large for the surgeon to have the least inquietude about the re-establishment of the circulation in this part of the limb, after the operation for aneurism; but in the hollow of the ham we no longer operate with the same confidence. Here the artery is solitary, (unique,) and the supplemental branches are but of small size. Thus the ancients, being persuaded that the obliteration of a trunk like this could not fail to bring on mortification of the parts that derive their nourishment from it, had, in order to cure aneurism and external wounds in the popliteal space, no other resource after compression and depleting means, than that of amputation of the thigh. J. L. Petit and Pott were tortured with these apprehensions. N. Guénaud (*Thèse de Haller*, t. V., p. 153; trad., t. III., p. 389) vainly endeavored to dispel them, and Bromfield (*Mém. de Chir. Etrang.*, t. III., p. 354) still qualified as extravagant the proposition to tie the femoral artery. If some more fortunate results were announced, they explained them by saying that an abnormal division of the vessel was the cause. It required nothing less than the operations performed by Guattani, Pelletan, Desault and Hunter, and especially the splendid researches of the indefatigable Scarpa, towards the beginning of the present century, to give predominance to an opposite opinion. To-day there is no longer any uncertainty in this matter; going from one extreme to the other, an aneurism in the ham is attacked almost with the same boldness as that of one of the tibial arteries.

§ IV.—*Treatment.*

Nevertheless, we should do wrong to dissemble that this operation is a serious one, and should not be performed for slight grounds, (*legèrement*;) so much so, that for aneurisms in the upper third of the leg, for example, I should decidedly give the preference to the ancient method, or even that of Brasdor.

A. The *depleting regimen*, applied to aneurisms of the popliteal artery, is a resource too uncertain and too dangerous to be seriously recommended.

B. Neither *cold applications* nor ice, to which all the patients at the Hospital of Incurables, at Naples, are still submitted, (De Renzi, trad. Ital. de ce traité, p. 71,) and which, M. Zaviziano informs me, he has often seen succeed in this establishment; nor potter's clay, with which, as a topical application, M. Kanelski has obtained complete success, have been followed by any considerable number of cures, unless in the practice of MM. Guerin and Dutrouilh, of Bordeaux.

C. *Indirect compression* either upon the tumor or above it, (i. e., on the cardiac side,) or upon the whole limb, has been more frequently followed by advantageous results than have the preceding methods. Guattani, Boyer, (t. II., p. 308—324,) Pelletan, (*Clin. Chirurg.*, t. I., p. 121,) Desgranges, Dupuytren, (*Bulletin de la Faculté*, t. VI., p. 242,) MM. Richerand, Ribes, (*Ibid.*, 7e année, p. 87,) and Viricel, (*Ibid.*, 6e année, p. 132,) relate examples of cures obtained by this means; but in the patient of Eschard, (Pelletan, *Clin. Chir.*, t. I., p. 115,) it required eleven months of treatment and absolute rest. M. Roux mentions a case where compression, applied successively upon different parts of the thigh, was followed by accidents of the most alarming character, and this without arresting the progress of the aneurism. Nevertheless, we may in timid, young, and feeble persons, who have a great repugnance to an operation properly so called, have recourse to it, either alone or combined with the refrigerants and the treatment of Valsalva.

A patient treated in that manner by M. Fabris, (*Bullet. de Férussac*, t. I., p. 346,) was perfectly cured. M. Chiari (Renzi, *Méd. Oper.*, trad., p. 346) thinks that his compressor above the tumor succeeds as well as the ligature by the method of Anel. Cumano (*Bullet. de Férussac*, t. XXI., p. 121) also says he has cured a popliteal aneurism by the compressor of Dupuytren. A. Dubois (*Bulletins de la Fac. de Méd.*, 6e année, p. 40) obtained a similar successful result at the beginning of this century. Upon the supposition that the patient may not bear it well, or that it aggravates instead of ameliorating the symptoms, it is easy to lay it aside and come to the last resource. When the disease has a tendency to disappear spontaneously, it cannot be denied that compression is calculated powerfully to aid the salutary efforts of nature. In such cases, at least, it may be followed by success.

D. In some cases also, we must add, the tumor has disappeared *without any assistance*. A man from the country came to the Hospital of Tours to be treated for an aneurism in the ham. The principal surgeons of the town were called in consultation. The necessity of the operation was unanimously conceded. But on the day after, the pulsations in the tumor had in great part ceased, so much so that in three days more they could not be perceived at all, and in two months the patient found himself perfectly cured, without having undergone an operation. Rest and regimen effected a similar result in a case cited by E. Ford; examined at a later period on the dead body, the popliteal artery was found a little dilated, and of about the size of a hazel-nut. We tried, says the author, to introduce a probe into its canal; it was obliterated, and it was not possible to penetrate it, even in using some force. This part of the artery was shut up by a firm and solid substance. The same patient had a femoral aneurism, which had terminated by gangrene of the tumor, which had caused his death, without producing either hemorrhage or effusion under the skin, though there was a crevice on its anterior part; a very thick clot by its strong adhesion to the gangrened integuments, presented an obstacle to the exit of the blood. Blizzard and Salmade have each related a similar case, and scientific collections afford a number of others that are not less remarkable. Moïnichen (Bonet, *Corps de Méd.*, t. IV., p. 56) saw a popliteal aneurism burst and recover without an operation.

E.—As to the *ligature*, it would seem from a letter of Testa to Cotugno, (Pelletan, *Clin. Chir.*, t. I., p. 137,) that Keisler or Keyslère, had used it a great number of times before it was spoken of in Italy. Lochman, another surgeon of Lorraine, operated in the same manner with success upon a patient at Florence in 1752, while Birchell (Guthrie, *Op. Cit.*, p. 144) ventured to do the same at the infirmary of Manchester in 1757. It was these facts, no doubt, which awakened the attention of Mazotti and Guattani. In his two operations Mazotti placed a second ligature below the arterial perforation; and it is with this modification that the method of Keisler was for the first time made trial of among us in 1780 by Pelletan.

In fact the ligature upon the popliteal artery might be performed by the three known methods. It has been performed a great number of times in France by Pelletan, Desault, Deschamps and Boyer, by the *ancient method*; but by this mode, it has appeared to present so many difficulties and dangers, that it has generally been renounced since the last ten or fifteen years. It is rare also, that the process of Anel taken literally, is had recourse to in aneurisms of the ham. Desault is the only one who has made use of it, and his case tends to prove that under such circumstances it is better to tie the femoral itself. Though the *method of Brasdor* has not yet been tried on this artery, I have not considered it right to pass it over in silence. If the tumour in fact should not have displaced (*deformé*) the parts to too great an extent, or should not be too

voluminous, or should occupy the femoral portion of the popliteal space, it has appeared to me probable, that we might sometimes succeed by placing the ligature below the disease, (i. e., on the distal side of the tumor, or by the method of Brasdor;) at the present day especially when we have the *process of M. Marchal*, I should not hesitate to attempt it. In conclusion then, it is only for aneurismal affections of the upper third of the leg that it may be advantageous to tie the popliteal artery, and consequently after the method of Anel only. We may after all, succeed with it without any great difficulty; perhaps also, we ought to prefer it when the subject is thin, and when every thing leads us to believe that the disease does not extend to the ham itself.

§ V.—*Operative Process.*

A.—*The ordinary process.* The patient is laid upon his belly and the leg held moderately extended.

I.—To reach the *portion of the artery in the leg* by the common method, we incise upon the median line, parallel with the axis of the limb and to the extent of three or four inches, both the skin and the sub-cutaneous tissue, taking care to push the external saphena vein to the outside, if it presents itself under the edge of the bistoury. The aponeurosis being once divided the instrument is no longer required; we tear apart (*déchire*) with caution the cellular and adipose tissue; then separate the attachment of the gastrocnemii muscles, and isolate the vessel from the nerves and the vein or veins which surround it, by means of the grooved sound.

II.—*Above the condyles*, it is easier to avoid the saphena, and the incision should be longer, and a little nearer to the internal than the external border of the ham, at least at its upper part, and following a direction slightly oblique in descending upon the inter-condyloid notch; under the aponeurosis are found the nerves, the vein soon after, and the artery quite at the bottom, and generally difficult to be detached from it, (the vein,) and always more deeply situated than in its lower half.

B.—*Process of Jobert and Ashmead.* In place of incising upon the posterior surface of the popliteal region, M. Jobert (*Bibliot. Méd.*, 1827, t. I., p. 229,) advises to cut down upon the artery by penetrating into the depression which is observed above the inner condyle of the femur, between the vastus internus and the internal border of the ham, when the leg is semi-flexed. In acting in this manner difficulties are created which do not exist in the ordinary method, and I do not think that the modification of M. Jobert ought to be adopted, notwithstanding the very precise rules which M. Ashmead, who believed himself the inventor of it, laid down for this method in 1829.

C.—*Process of Marchal.* Maintaining with reason that the ligature upon the popliteal artery, is, all other things being equal, less serious than that upon the femoral, M. Marchal (*Thèse No. 156*,

Paris, 1837,) proposes a new mode of proceeding. The patient is laid upon his back, having the leg turned outwardly, and moderately flexed. The surgeon keeping along the outer side of the semitendinosus, divides the integuments to the extent of about three inches upon an oblique line which extends from the hollow of the ham to the internal border of the tibia, taking care to avoid the saphena. After having cut through the aponeurosis a little farther behind, he inserts his finger between the inner portion of the gastrocnemius internus and the popliteus muscle, in order to separate the cellulo-adipose tissue. A greater degree of flexion of the leg then allows him to distinguish the vascular bundle (*faiseeau*), and to pass the ligature around the artery. This process, which could take the title of the method of Brasdor, if it was applied to aneurisms in the popliteal space, (*creux*), and that of the method of Anel, in cases of disease of the arteries in the calf or upper part of the leg, is evidently preferable to the ancient, and while it does not allow of our attacking the femoral artery for wounds of the arteries of the leg, relieves us from the necessity of following the precepts of M. Guthrie, (*vid. supra*.)

D.—*Consequences of the operation.* Whatever may be the mode, method or process, which has brought about the cure, when the popliteal artery is in question, the resources which nature employs to re-establish the course of the blood are always the same. The obliteration of the vessel is prolonged to a certain extent above and below the wound or the part included in the ligature; the branches which allow the perforating arteries to communicate with the superior articular arteries, and these latter and some branches of the superficial femoral with the inferior articular arteries, surales, and the tibial recurrent of the knee, gradually augment in volume, and ultimately form a very beautiful net-work about the articulation. The blood then passes with sufficient ease from the thigh to the arterial canals of the leg.

There exists in the Museum of the Faculty an anatomical specimen, prepared by Ribes, and taken from a subject who had been a long time before cured by Sabatier, which gives the proof of this arrangement. We find a sketch of a similar preparation in the first volume of the Clinique of Pelletan. MM. A. Cooper, Hodgson, Dupuytren, &c., have observed the same fact in a number of dead subjects; and I had an opportunity of corroborating the truth of it in 1823, upon the dead body of the first patient operated upon at Paris, by the ligature, for popliteal aneurism. It was in 1780 that this man came to receive the advice of Pelletan; he was then thirty-two years of age, and died consequently at the age of eighty-four. The trunk of the popliteal artery was transformed into a fibro-cellular cord, quite small and of little resistance throughout its whole extent; the superior articular arteries, internal and external, the anastomotic and a branch of the superficial muscular supplied by the femoral, had acquired the size of huge crow's quills, and formed large tortuous (*flexueuses*) areades upon the sides of the patella and the condyles, becoming *continuous* with the recurrent of the anterior tibial, the inferior

articular arteries, &c.; the limb moreover was exceedingly well nourished, and did not differ in other respects from that of the opposite side.

ARTICLE VI.—FEMORAL ARTERY.

§ I—*Anatomy.*

Reaching from the crural arch to the lower third of the thigh, the femoral artery follows the direction of a line slightly spiroidal (spiroïde) which from the middle of Poupart's ligament, would descend obliquely inwards, and following also the track of the popliteal, terminate between the two condyles. The vein attached to its inner and posterior surface, is united to it by dense cellular tissue, which forms a species of common sheath for both. The principal branch of the crural nerve, lying first on its outer side, gradually gets upon its anterior surface and sometimes even to its inner border in proportion as it descends, but far below leaves it altogether in order to pass between the muscles which form the border of the ham. Another nerve of not less size, sometimes crosses its upper portion, and continues before it and the vein down to near the middle of the thigh.

A.—*Relations.* A fibrous sheath, formed out of substance (épaisseur) of the deep layer of the *fascia lata*, envelopes the whole of it, and presents an arrangement which it is important to notice. The anterior wall of this sheath gradually increases in thickness in proportion as it descends, so that in the groin we can easily tear it with the sound, while below it often opposes a great degree of resistance; below it is continuous with the fibrous expansion, or more properly with the terminating aponeurosis of the second and third adductor muscles. The artery is afterwards covered by the sartorius muscle which crosses it very obliquely from without inward, and which does not in reality conceal but its two lower thirds, leaving it free above to the extent of some inches. In the last mentioned portion, it is covered by the deep lymphatic ganglions and by pelotons of filamentous cellular tissue. It is only when it approaches the gracilis muscle, to form the apex of the inguinal triangle, that its inner border begins to separate itself from the superficial layer of the aponeurosis of the thigh, which lies in almost naked contact with it in the fold of the groin. In proceeding toward the skin, after leaving the sartorius, we find the first layer of the *fascia lata*, then the sub-cutaneous fascia enclosing the branches of the saphena, which latter is almost always situated within the line of the course of the artery.

Among the branches of the femoral, there are several which the surgeon should not forget; these are:—1, the profunda, which is given off from it at about two inches from Poupart's ligament, in order to penetrate down to the level of the little trochanter, under the aponeurosis, and to furnish as it divides the three

perforating; 2, the circumflex arteries, which ordinarily rise a little higher up or some lines below, and more frequently still from the profunda itself; 3, the superficial muscular, which gives off the external circumflex and which descends down to the knee to anastomose with the branches of the popliteal; 4, the great anastomotic, which has its origin near the commencement of the popliteal, and proceeds to the inner side of the knee while continuing by the side of the upper surface of the third adductor muscle.

B.—*Anomalies.* The secondary branches of the femoral are subject to numerous anomalies; but they are very seldom found on the trunk itself. Morgagni, who thinks it is often double, had imagined it so, but had never seen it; the same may be said of Haller; nevertheless, Gooch gives three instances of it; M. Casamayor points out a fourth, and I have met with a fifth. In that of my own the supernumerary artery was evidently only a continuation of the profunda, which, after having furnished the perforating, retained sufficient size to descend to below the knee. In a subject affected with aneurism in the ham, M. Bell found the femoral divided into two trunks of equal volume, which did not unite until they formed the popliteal. M. J. Houston, Conservator of the Anatomical Museum at Dublin, cites a similar fact. MM. Bronson and Cromwell pointed out to me, in 1825, in the rooms of the School of Practice, a different variety. In place of remaining contiguous to the artery, the crural vein had, on the contrary separated itself from it at its origin, so as not to rejoin it, until at its entrance into the popliteal space, after having formed a long arch, whose convexity was turned towards the internal border of the thigh. I have since met, in one instance, with the same arrangement, which moreover it is only necessary to point out that each one may estimate the value that is to be attached to it in operative surgery. In a subject of which M. Manec has shown me the specimen, the femoral artery, which was wanting in front, was replaced behind by the descending branch of the ischiatic. In a dead body dissected by M. Caillard, it lost itself at the lower part of the thigh, without giving off the popliteal. (*Thèse* No. 307, Paris.)

§ II.—*The Different Kinds of Aneurism, and the Indications.*

If traumatic aneurism is quite rare in the popliteal space, it is not the same in the thigh, where the artery badly protected in front is obliged to follow the movements of the hip joint. M. Champion writes me, that though engaged in a very extensive practice of more than thirty years, in a circuit of twenty-five leagues, he and M. Moreau, of Bar-le-duc, have never met with a spontaneous aneurism in the thigh. I have, however, myself already seen seven examples of it. We often meet, in this part, with diffused, and also with false circumscribed aneurism; nor is it any more protected from varicose aneurism, (*aneurisme variqueux*), as is proved by a case of M. Larrey. MM. Fleischer, (*Bulletin de Ferrussac*, t. VI., p. 343,) Guersent, the son, Perry, (*Rev. Méd.*, 1836,

t. II., p. 421,) Venturoli, (*Gaz. Méd. de Paris*, 1736, p. 200,) and before them Bourguet, (*Sur un Aneur.*, &c., an IV., in 8vo,) have also published examples of it: and I have myself seen two cases, (*Dict. de Méd.*, 2d edit., art. Femorale.)

Inferiorly, the sartorius tends in general to make the tumor glide forward; superiorly it would push it rather inwards; which, with the slight degree of density of the aponeurosis near Poupart's ligament, sufficiently explains a remark made by a number of practitioners, to wit, that in the groin the opening of the vessel corresponds almost always to the lower third of the aneurismal sac. Surrounded with parts having but little solidity, aneurisms of the femoral artery may rapidly acquire a very great degree of development; nevertheless, as they neither involve nerves of large size, nor any important articulation, they are, all other things being equal, accompanied with accidents less numerous than those of the popliteal artery.

A.—*Spontaneous Cure.* Notwithstanding the size of the artery which has given origin to them, aneurisms of the thigh, left to themselves, are not always fatal. In a case, cited by M. A. Severin, the inguinal tumor was attacked with gangrene; after the fall of the escars the wound cicatrized little by little; there was no hemorrhage, and the limb returned to its natural state. Lancisi has seen an aneurism of the same kind, though very large, diminish by degrees, and ultimately disappear under the treatment of simple fomentations, warm baths, and diluents. Guattani, at Rome, in 1765, saw in a cook the same thing occur, as in the case of M. A. Severin. In 1784, Clarke noticed a similar case. Ford has seen an aneurism in the thigh get well without any other assistance than diet and rest. In 1808, M. Spalding, after having opened and cleaned an enormous crural aneurism, was astonished to find the artery obliterated above and below its laceration, and that not a drop of blood flowed from it. M. Hodgson has met, in the dead body, in the lower third of the thigh, with an aneurismal sac, whose coagulum, of remarkably solid texture, completely obliterated the artery, to the origin of the profunda in one direction, and down to the commencement of the leg in the other. M. Marjolin makes mention of an aneurism in the middle of the femoral, in a man aged sixty years, and which became transformed into an abscess, and ultimately got well after a long suppuration. M. Guthrie (*Oper. Cit.*, p. 97) mentions a similar case, noticed in the hospital at York. The varicose aneurism, noticed by Bourguet, also recovered without an operation. The autopsy of the dead body, at a later period, allowed of an opportunity of verifying the state of the parts.

B.—*The Refrigerating Method.* Antiphlogistics, regimen and compression have also procured some fortunate results in the thigh. Hodgson gives many cases of this kind. At Bordeaux, M. Treylan succeeded in curing a femoral aneurism by bleedings, cold applications, &c., in a patient who had another in the opposite leg. M. Larrey speaks of a sergeant of the guard, who, in April, 1817,

received a sabre wound in the upper part of the right thigh. A false circumscribed aneurism was the result, but the treatment of Valsalva, aided by cold topical applications, soon succeeded in curing the disease. The successful case cited by M. Andreini, also has reference to an aneurism in the thigh. According to M. Ribes, Sabatier succeeded in the same manner in a patient who had two aneurisms in the same limb, one in the thigh, the other in the ham. A patient of M. Lyford (*Bulletin de Férussac*, t. XVII., p. 394) was also cured without an operation. The aneurism, in the case of M. Faulcon (*Gaz. Méd. de Paris*, 1837, p. 313) did not shrink (*s'affaissa*) until after all compression had been suspended.

C.—*Compression.* The observations of Arnaud, Mayer, Kinglake, Albert, (*London Medical Gazette*, t. IX., p. 28.) Dubois, (*Bullet. de la Fac.*, 6e année, p. 40.) Dupuytren, and M. Pigeaux, prove that compression alone is capable of producing the same results; it is for this purpose that Guattani and Thédén have so warmly urged their mode of bandaging. If such means enabled us, as was thought up to the end of the last century, to cure aneurism, without obliterating the artery, we ought assuredly always to make trial of them before coming to the ligature; but the contrary having been demonstrated, it is always found infinitely more simple to recur immediately to the last. It is, nevertheless, true, that Professor Chiari (Velpeau, *Méd. Oper.* trad. de M. Renzi, p. 118) asserts, that he has, within a few years past, eight or ten times obliterated large arteries, the carotid and femoral especially, by means of a compressor of his invention. E. Ford (*Mem. Cit.*, p. 115) says, that after having intermitted, in a patient who could not bear it, the compression attempted in the fold of the groin for an aneurism of the femoral artery, he afterwards saw that the tumor ceased to pulsate, and that the cure took place. (See note on Compression, *supra*.)

§ III.—*The Operation.*

The ligature upon the femoral artery is at the present time an operation very frequently performed. It is this which is preferred for most of the lesions of the popliteal artery, and even for aneurisms of the leg, as we have seen above. Nevertheless, many centuries elapsed before this operation was hazarded. Severin and Trullus had made trial of it successfully for an aneurism situated at eight fingers' breadth below the groin; Bottentuit (Saviard, *Observat. Chirurg.*, p. 277, Obs. 63.) did the same, and with a similar fortunate result, at the Hotel Dieu, of Paris, in 1688; Guattani had substituted for it, with the like complete success, indirect compression made upon the trunk of the artery, under Poupart's ligament; but nothing, then, inspired surgeons with confidence. It was not until after having reflected upon the numerous anastomosing branches pointed out by Winslow and Haller, that Heister ventured to propose the ligature of the artery for certain cases of aneurism in the thigh. A short time after, Hamilton, Burchall,

Leber, and Jussy, made it apparent, that after this ligature the circulation is re-established with facility in the lower part of the limb, and that it was an error to entertain any fears of such an operation. As the trials, according to Pott, Wilmer, and Kirkland, that were made of it in England, from 1760 to 1780, were much less encouraging than they had been in Italy for twenty years preceding, it required nothing short of the successful results of Desault, Hunter, and Pelletan, to give to it ultimately its proper rank, and to cause it to be generally adopted. Laugier, (*Ann. de Marseille*, t. I., p. 135,) who had the boldness to place the ligature at two inches below Poupart's ligament, also obtained a fortunate result. A recent wound obliged M. Fardeau (*Communication de M. Barthélemy*,) to operate in the same place, or above the great muscular, and this patient also recovered. Applying it, in two cases, on the wound itself, near the middle of the thigh, M. Champion (*Communiqué par l'Auteur*) was equally successful. M. Pl. Portal (*Il Severino*, 1834, vol. III., p. 101) was not less fortunate in applying it immediately after the wound occurred, in the case of a priest aged seventy years. It is, therefore, at present, a question definitively adjudged. We may, in fact, for wounds, as for aneurisms, tie this artery, at all the different points of the thigh, but not everywhere, however, with the same chances of success. So long as the profunda of the femoral is avoided, the danger is not extreme, though greater than when the ligature is applied upon the popliteal artery. When, on the contrary, we have been forced to sacrifice the great muscular, it is evident that the blood cannot any longer arrive at the limb, but by the secondary branches, which are distributed to the pelvis.

A. Of the *three essential methods*, that of Anel is almost the only one now in use for the thigh. That of Keisler so frequently practised by Desault, Pelletan, Deschamps, and M. Roux, and which has so long prevailed in France, is no longer recommended by Boyer himself, in the second edition of his work, except in a small number of cases. Nevertheless some persons have continued to accord to it the preference in varicose aneurism and diffused traumatic aneurism, and especially where the tumor is too nearly approximated to the fold of the groin to allow of our placing a ligature between it and the profunda without wounding it. In 1826, I saw M. Roux operate by this method for an aneurism in the upper third of the thigh, and the result was perfectly satisfactory. It is true, as Boyer says, if the tumor extends up to the fold of the groin, we may by opening into it, easily preserve the deep muscular; which would be impossible by the new method. It remains to be seen if this advantage is sufficiently important to compensate for the inconveniences to which we are exposed. The ligatures upon the iliac have proved that in such cases, the artery in question is not indispensable to the maintenance of life in the limb. But what regrets we should have if after having voided the aneurismal sac, we should find that the femoral artery was perforated higher up than we supposed, or that the walls of its upper

end were too diseased to sustain the pressure of the ligature! Would it not be better in such cases to follow the method of Brasdor?

B. Consequently we cannot see that there can hardly ever be any absolute necessity of opening the sac to tie the crural artery, except in aneurisms produced by external causes, or in those that are diffused, or of very large size, or situated very high up.

In employing the method of Anel in the treatment of aneurisms in the lower limb, Desault applied his ligature at the apex of the popliteal space, and not upon the femoral, properly so called. M. Martin says that Spezanni had performed it on the thigh four years before, with the intention of disarticulating the limb when the gangrene should be arrested, and that the patient's limb was saved.

As I have already said, it is asserted on the other hand that for a long time before it was spoken of in England, Brasdor had publicly recommended it in his lectures at the schools of surgery, while Tissot (Trad. de Bilguer, *Sur l'Amputat.*, p. 115) had proposed in the year 1778 to tie the femoral artery very high up. It cannot nevertheless be denied that it is to Hunter the merit belongs of having ultimately awakened the attention of European surgeons to this fortunate improvement. He made his incision a little below the middle of the thigh upon the inner border of the sartorius muscle, laid the artery bare to the extent of three inches, and passed four ligatures around it.

Scarpa recommends that we should operate at only four fingers' width from Poupart's ligament, justifying himself upon the fact that there is nothing more easy than to find the vessel in this place, that there is no important collateral to avoid, and that being also as remote as possible from the aneurism, we have much more chance of meeting with a sound part of the tube to sustain the ligature.

The reasoning of Scarpa has not convinced every one; most French surgeons think, and with reason in my opinion, that it is useless to go up to the inguinal space, even for aneurisms of the thigh, unless we are forced to do so by the situation of the disease. They rarely go as far from fear of approaching the profunda, of sacrificing too many of the collaterals, and of thus interfering with the formation of the clot. It is therefore proper to make known also the manner of tying the femoral artery in the two principal regions of its track, that is to say, above and below its middle portion.

C. The *temporary ligature* also has been often made trial of in the thigh. M. Canella (*Bulletin de Férussac*, t. XVIII., p. 431) withdrew his ligature on the fifth day, but the patient died. M. Falcieri (Ibid., t. XIX., p. 277) did not leave it on even as long as four days, yet his patient recovered. It was removed from the artery upon the third day in the case of M. Balestra, (*Bulletin de Férussac*, t. II., p. 334,) and the aneurism disappeared. M. Morigi, (Valentin, *Voyage en Italie*, 2d edit., p. 317,) who removed his two ligatures on the fourth day, also succeeded. In France the different

kinds of artery compressors are no longer spoken of. [A different state of things since M. Velpeau published this work in the year 1839, exists now. See our note on compression, *supra*. T.]

D. It is surprising, to say the least of it, that the precept to include the vein and nerve in the ligature with the artery has been renewed in our days, and principally upon the femoral. M. Grillo (*Gazette Méd. de Paris*, 1834, p. 539) who extols this method, says he has practised it fifteen times, and that all his patients were cured! It is also upon the femoral artery that M. Ghidella (*Bulletin de Férussac*, t. XXIV., p. 172) has applied this rule with success. To tie it upon two places with the interposition of a rouleau of adhesive plaster, and to cut it between the two ligatures, is a method which M. Petrunti (Il filiatre Sebezzio, Avril, 1836, p. 244) still prefers, and of which he gives two examples, one of which recovered and the other died.

§ III.—Operative Process.

A. *Lower half*.—It is in this place that it would be prudent to seek the vessel, when we are treating wounds or aneurisms either of the leg or ham by the method of Anel, in the same way as for those of the inguinal region we would use the method of Brasdor. The limb is slightly flexed and turned outwardly. An incision of about three inches is then made into the soft parts, so that half of it extends upon the middle third and half on the lower third of the thigh. Lower down, at some three or four fingers width only above the knee, as some persons have doubtless inadvertently advised, we should not find the artery, because it has entered then into the hollow of the ham; higher up we should come into the process of Scarpa.

I. In the *operations of Hunter*, this incision being obliquely from without inwards, fell upon the inner border of the sartorius, which was turned forward in order to lay bare the sheath of the vessels. Then we encounter successively the skin, which is generally quite thin, afterwards the adipose layer and the saphena vein, which it is important not to wound, and the superficial layer of the aponeurosis or sheath of the sartorius muscle; and under this last quite deep down and near the femur, and in the groove (*gouttière*) which separates the vastus internus from the adductors, we have a second fibrous layer to divide.

II. M. Roux on the contrary recommends that the incision should be made on the outer edge of the sartorius, which is to be pushed inwardly in order to reach the artery. It is also the advice which M. Hutchison gave in 1811, seeing, says he, that in this manner we are sure to avoid the great saphena vein; we have here also the same number of layers to divide as in the process of Hunter.

III. Seeing that by one mode as well as by the other, we are obliged to displace the muscle which conceals the vessels, and to turn it aside either within or outwards, M. Hodgson thought it would be better to divide (*decouvrir*) the middle portion of it, a

suggestion in fact which had already been made by Desault, who asserts besides, and with reason, that we may without inconvenience make a transverse section of this fleshy bundle, when it embarrasses the operation by its presence or by its contractions. [The division of the sartorius since the discoveries of tenotomy and myotomy must now be a consideration of the least degree of moment, as its ready reunion would soon restore to it all its functions. This remark will apply to the division of muscles of far greater magnitude, and to all operations where they present serious impediments. T.]

IV. In the process of Hunter the wound is not so deep; being made near the inner border of the thigh, it is easy after the operation to give it a depending position (*une position déclive*;) nevertheless it may be objected that a wound of the saphena without being dangerous in itself may have a tendency to cause gangrene, if the crural vein should be found included in the ligature or obliterated in any manner whatever, as is seen for example in a case mentioned by M. Bégin; also, it is remarked, that if in the place of coming down upon the sheath of the sartorius we should lay bare the gracilis muscle, we might readily be deceived, and that the depending position urged with so much zeal in theory, may be neglected here without any great inconvenience. The process of M. Hutchison also may lead to some mistakes. In carrying the bistoury too much outwardly, it happens sometimes that we fall upon the triceps muscle, and that if the error is not immediately perceived the operation becomes very laborious. To avoid this inconvenience, it is sufficient fortunately to recollect that the fibres of the sartorius, parallel to each other and to the axis of the muscle or to that of the limb, are without any admixture of fat; while those of the vastus internus, fasciculated or intermingled with cellular or adipose lamellæ, are all oblique from above downwards, from behind forwards, and from the internal border of the femur towards the anterior median line of the thigh.

V. The most prudent course therefore is to conform to the advice of Desault or of M. Hodgson, which allows us, as soon as the first aponeurosis is divided, to arrive almost with equal facility at the internal or external border of the sartorius. As to the section practised by Desault, though it may be less dangerous than was thought formerly, it is better not to have recourse to it without there is an absolute necessity. In theory it is difficult to conceive how it can ever become indispensable except in the ancient method.

B. *Upper Half*.—Above the middle of the thigh an incision of two to three inches suffices to lay bare the trunk of the femoral artery. The middle part of this incision should be found at the distance of four fingers' width from Poupart's ligament, unless we should be obliged to make it immediately under the crural arch, and to go down between the profunda artery and the epigastric. In all cases we carry the bistoury in the direction of the line which represents the track of the vessel, and in consequence of the saphena vein, rather a little outward than too much inwardly. After pass-

ing the skin and the adipose tissue, the aponeurosis presents itself to the eye of the operator ; before dividing it, it is well to recollect that, below, the internal edge of the sartorius ordinarily separates it from the artery, which is no longer the case in the upper part of the inguinal triangle. This sheath being opened, and the muscle pushed outwardly as much as is necessary, we pass a grooved sound to serve as a conductor to the bistoury, under the superficial layer of the arterial sheath, in order to cut it without danger and to the same extent as the rest of the wound. Finally we isolate the vessel, seizing it by its inner border and with the usual precautions so as not to wound either the crural vein or the nerves in the neighborhood.

C. *Consequences of the Operation.*—After this operation, whether it has been performed higher up or lower down, the vessels charged with re-establishing the course of the blood are nearly the same. The branches of the superficial muscular pour out this fluid into the great anastomosing artery, the external articular arteries or the tibial recurrent, and those of the profunda, or the perforating arteries, into the internal articular arteries. It returns sometimes by the intermediate muscular arteries between the ligature and the tumor, whose pulsations may thus be kept up, and interfere with the resolution during a variable period of time. This inconvenience which had at first been deemed very serious, no longer at the present day causes the same inquietude. Cold and resolvent applications, aided by slight compression, in general, causes it promptly to disappear, when we do not think proper to leave it to itself. The facts opposed to this statement, however, are less rare and more authentic than is generally thought.

I. Monteith has seen the *pulsations return* in the tumor many months after the cure ; an aneurism operated upon in 1821, by M. Cumming, reappeared in 1825 to such extent as to make it necessary to amputate the thigh. In a patient in whom I had tied the femoral artery at three inches below the profunda, a *hemorrhage from the lower end* took place after the fall of the ligature on the thirteenth day. A new ligature above did not arrest the blood ; it was necessary to unite compression with it below the wound. M. Smith, (Journ. des Conn. Méd. Chir., t. II., p. 192,) who had operated in the same way, saw the hemorrhage supervene on the twelfth day. A ligature upon the femoral above the profunda did not prevent the hemorrhage from returning eight days after. Direct compression arrested it completely. An aneurism which existed in the other thigh was cured at the same time. It is then an accident quite frequent. Bromfield cites an instance of it from J. Hunter, and M. Guthrie also enumerates several.

II. When it has not been possible to preserve the deep-seated muscular artery, it is by the branches of the epigastric that the *circulation is re-established* ; the gluteal, the ischiatic, the internal pudic, and obturator inosculate with the circumflex and perforating arteries, and these disgorge themselves, as has been said above, into the arteries in the neighborhood of the knee.

III. Not only has the femoral artery been tied for its own aneurisms and for those of the popliteal space, but also for certain diseases of the leg. If those *aneurismal tumors* which develop themselves in the substance (*épaisseur*) of the bones, tumors which Pott and Scarpa were the first to mention, of which Pelletan cites many cases, and which have been three times seen at the Hotel Dieu by Dupuytren, (*Repert. d'Anat., de Phys., et de Path., etc.*,) should again be met with under the knee, as has been seen by M. Lallemand, (*Archiv. Gén. de Méd.*, t. XIII., p. 544,) in the canal of the tibia, for example, as has been noticed by Rossi, (t. II., p. 66, *en note*,) or in the thigh, (Lallemand, *Bulletin de Férussac*, t. XV., p. 73,) it would no longer be necessary in order to effect a cure in any of those cases, as was formerly thought, to amputate the limb; the ligature upon the femoral, by the method of Anel suffices; it succeeded completely with M. Lallemand and Pearson.

IV. Notwithstanding all this, the ligature upon the femoral artery is an operation much more dangerous than the observations of modern surgeons might induce us to believe. It is true that in an enumeration of fifty cases, I do not find but eight instances of death; that M. Mott has told me that he has lost but one patient out of that number; that M. Roux also declares that he has cured almost all his cases; that everywhere successes are spoken of, and that no one mentions failures; but I deem it just to declare that out of seven persons, who, to my knowledge, were submitted to the ligature upon the femoral artery for aneurisms, in 1837 and 1838, in the hospitals of Paris, three are dead; that a patient operated upon at Naples (De Renzi, *Oper.*, t. I., p. 109,) and another of whom M. Lauchlan, (*Gaz. Méd.*, 1838, p. 487,) speaks, both succumbed; that gangrene made it necessary to amputate the thigh in that of M. S. Cooper, (*Arch. Gén. de Méd.*, 2e série, t. I., p. 281,) that at the Hotel Dieu, in the department of Dupuytren, a great number died, and that all the cases of this kind are not known. Though now they are scarcely ever any more spoken of, yet I find in about sixty cases of this operation, twelve examples of gangrene, and thirteen of hemorrhage, without counting abscesses. The hemorrhage moreover supervened on the 3d, 4th, 9th, and 15th days; twice on the 16th, 21st, 22d, 12th and 8th days, and twice on the 40th day. It is enough I think to induce practitioners not to tie the femoral artery without the necessity for it is fully established.

The gravity of this operation being well ascertained, would it not suffice, now that the process of M. Marchal is known, to induce us in cases of wounds or aneurisms of the leg, to tie rather the termination of the popliteal artery than the femoral itself? We may, moreover, do this with much less danger for the arrest of hemorrhages which sometimes supervene after amputation, (Arnal, *Journ. Hebdom.*, t. VII., p. 209,) or which are complicated with fractures of the thigh. Patients thus operated upon by MM. Roux, (*Ibid.*, p. 209-10,) Gerdy, (*Arch. Gén. de Méd.*, 1834, Beaugrand,) Jobert, (*Journ. Hebdom.*, t. VII., p. 210,) and Ch. Bell, (J. Bell, *Trait. des Pl.*, p. 200,) have recovered perfectly. Nevertheless M. Roux,

(Dubourg, *Journ. Hebd. Universel*, t. I., p. 45,) was less fortunate in 1830, in two patients who had had the crural artery opened.

ARTICLE VII.—BRANCHES OF THE FEMORAL ARTERY.

Wounds of the thigh sometimes give rise to serious hemorrhages, and even to aneurisms, though the trunk of the femoral artery may remain intact. In a patient of Abernethy, who met with a fall, hemorrhage ensued from a soft cancer; a ligature at the groin proved insufficient, but compression with the fingers effected a cure, (Abernethy, *Mélang. de Chir.*, t. II., p. 469.)

We find the following case in Hevin, (*Cours de Pathol. et de Therapeut.*, t. II., p. 48.) A wound upon the middle and inner part of the thigh, from a sabre-cut, hemorrhage, application of vitriol, (bouton de vitriol,) compression, tourniquet, and tumefaction to a very considerable extent in the lower part of the thigh as well as in the leg, where there were already phlyctenæ. Foubert, Petit, Morand, Ledran and Faget decide with Hevin that amputation should be performed. Though the femoral artery in this case remained intact, a considerable branch was wounded at four or five lines distant from its origin in the trunk. This probably is the same case that M. Arbey (*Coup d'œil sur l'Amput.*, 1815, p. 7) says he had heard of, from a professor of Strasbourg. M. Champion writes me :—I was called to apply a ligature upon the femoral, in consequence of a hemorrhage from the middle and inner part of the thigh, produced by a wound from an iron pitch-fork. The blood had ceased to flow under the compressive dressing; it had effused itself throughout the whole thigh; but as the engorgement did not increase, I resolved to wait, and the patient recovered.

A young man who received a wound above and outside of the patella, died at La Charité (*Médec. Operat.*, t. I., p. 283) in 1838, from repeated hemorrhages. The blood came from an articular branch. Another patient, who had a similar wound above and inside the patella, presented a short time after similar accidents; but a free dilatation, with compression, finally arrested the flow of blood. The point of a knife, striking perpendicularly upon the fore part of the femur above the knee has twice occasioned me similar trouble. A case has also been stated (*Séance Publique de l'Académie de Chirurgie*, 1748) of an aneurism of the superficial muscular artery, cured by compression; and M. Mauban, (*Bullet. de la Soc. Méd. d'Emul.*, t. VI., p. 238,) making use of the same means, professes to have cured one in the circumflex of the knee.

If one of the circumflex arteries or the profunda should be divided, or become the seat of an aneurism, it would not in general be very difficult to apply a ligature to it. The essential point would be to verify (reconnoître) such a lesion. In laying bare the trunk of the femoral at its exit from the crural arch, we could, without difficulty, apply ligature upon the root of the affected artery. M.

Roux and another surgeon whose case I cannot now find, are the only ones who have had occasion to operate in this manner upon one of its secondary branches, namely, upon the internal or external circumflex artery of the thigh. The danger of a ligature upon the trunk of the femoral is too great, in my estimation, not to make it obligatory on the surgeon before coming to this operation to search carefully for the wounded branch, even though it were necessary in order to effect this, to make a large and deep incision.

[Spontaneous Cure of Femoral Aneurism by Valsalva's Mode.]

Mr. Elsworth, (see *London Medical Times*, January, February and March, 1844,) relates the case of a sailor, aged 47, received at St. George's Hospital in November, 1841, with an aneurismal tumor of the femoral artery of the size of a pigeon's egg, situated under Poupert's ligament. Having refused to have the external iliac tied, the patient was put upon the regimen of absolute rest and severe depletion, the thigh being kept semi-flexed on the pelvis. In a month, the tumor still retaining its dimensions, exhibited no longer any strong pulsations, which latter entirely ceased at the end of another month. Nor were they perceptible in the external iliac above it. In the summer of 1843 the patient, who had left the hospital, returned to show that the disease had been completely cured; nothing remaining in the groin but a small, hard, non-pulsating tumor of the size of a nut. Pulsation also had ceased in the external iliac and femoral.

Popliteal Aneurism in a Child.

Mr. Syme gives (Cormack's *Lond. and Ed. Monthly Journal of Med. Science*, Oct. 1844, p. 823, et seq.) a case of popliteal aneurism in a child, aged 7 years, in whom the tumor extended from the lower part of the popliteal space under the bellies of the gastrocnemii muscles so as to distend the calf of the leg. The whole tumor nearly disappeared under temporary compression of the tumor itself, or of the femoral artery. It rapidly increased between the age of 7 and 9 years, at which latter period Mr. Syme tied the femoral, and in a month dismissed his patient with a solid tumor of coagulum in its place of much smaller size. Sir A. Cooper never met with an aneurism earlier than at the age of eleven, and that was of the anterior tibial in a boy, (Lectures on Surgery, vol. II., p. 41.) Dr. Peach, however, informed Mr. Syme, (Cormack, *ib.*, p. 824,) that he had witnessed the amputation of a child's thigh for popliteal aneurism of a very large size. And Dr. Croft also mentioned to the professor of Edinburgh (*Ibid.*) that he had seen in the museum of an English provincial hospital the preparation of a *carotid aneurism*, for which the artery had been tied without success in a child of seven or eight years of age.

As an illustration of the singular manner in which a large artery and vein may escape being wounded, though lying in the track of a ball, M. Guthrie, (Cormack's *Lond. and Edin. Monthly Journal*, &c., Dec. 1844, p. 1043,) has a preparation showing where a ball passed *between the femoral artery and vein* without wounding either. T.]

ARTICLE VIII.—EXTERNAL ILIAC.

§ I.—*Anatomy.*

From the line of the sacro-iliac symphysis, where the primitive iliac artery bifurcates, to its passage under Poupart's ligament, the external iliac represents a slight curve, with its convexity outward and backward. Resting against the psoas muscles outwardly, and upon the iliac vein behind and within, it is covered directly by an expansion of the *facia iliaca*. The crural nerve is separated from it by the tendon of the psoas, and by a very strong aponeurosis. A branch of the genito-crural nerve, sometimes runs along its inner and anterior surface, which latter is crossed by the ureter, and in women by the ovarian vessels. The peritoneum, which at the same time conceals these various parts, adheres to it but very feebly by means of a very loose adipose layer, and even abandons it altogether in front, to be reflected upon the posterior surface of the abdominal walls.

At its entrance into the crural canal, the external iliac artery gradually rises upwards, becomes much more superficial, and contracts some new relations. In that place it is supported by the body of the pubis, and the origin of the pectinæus muscle; the vas deferens crosses it in descending into the pelvis; the testicular cord, as it passes over the inguinal canal, does the same. The epigastric vein also is obliged to cross it, in order to open itself into the iliac vein, which latter keeps close to it, as in the thigh; the fibrous layer, which binds it down against the psoas and iliac muscles, has become sensibly thinner; the anterior iliac artery, and the epigastric, the only ones which it gives off, separate themselves from it, the one a little outwardly, the other a little inwardly, ordinarily at the level of the ilio-pectinæal crest, sometimes higher, and sometimes lower, by from four to six, or eight lines. The lymphatic ganglions which surround it, as far as the crural arch, and which, in becoming swollen, might compress it, have sometimes given occasion to the suspicion of diseases which did not exist. The cæcum, on the right, and the sigmoid flexure of the colon on the left, are the only viscera which separate it from the walls of the belly. Nothing is more easy in lean subjects, and when all the muscles are in a state of relaxation, than to make sufficient indirect *compression* upon it, to close it, as has been observed by Bogros, (*Thèse* No. 153, Paris, 1823,) and as I have shown farther above.

Its *anomalies* hardly ever relate to other circumstances than its

length, its size, and curvature, and to the points of origin of its principal branches. It may, however, happen that it will be composed of two trunks, placed by the side of each other, and which pass together under the crural arch, as M. James has seen in a patient in whom he tied the iliac artery, by the method of Brasdor.

§ II.—*Indications.*

The external iliac artery is rarely the seat of spontaneous aneurisms. If, in fact, it should be opened by an external cause, the patient would necessarily die from the hemorrhage, before it would be possible to afford him the least assistance. M. Larrey, however, says, he has seen a varicose aneurism here, and I was fortunate enough, owing to the presence of mind of MM. Layraud and Durand, to cure, by means of the ligature, a boy in whom it was opened by accident. M. Carron du Villards relates, that M. Barbaud (Sanson, *Thèse de Concours*, p. 339) had the same good fortune in a carpenter, who had the fold of the groin largely torn by a nail. But as it is not an external artery, and has only from four to five inches length, aneurisms, even from internal causes, cannot be very common here. The case of the young man I have mentioned above, is, probably, the only one of its kind, as will be mentioned further on.

If the dread of gangrene, from the obliteration of a large arterial trunk, has been enabled to maintain its ground for so many centuries, in the presence of aneurisms of the thigh, and of the popliteal region, with much stronger reason, would even the very suggestion have been reprobated, of placing a ligature upon one of the first divisions of the aorta. Facts passed unheeded by, and science could not profit by them. In the case of Guattani, the compression was made above the profunda artery, and the circulation maintained itself in the limb. Baillie had found the femoral artery obliterated up to within the pelvis, in the dead body of a man, in whom the pelvic limb was in no ways altered. Guattani noticed a similar fact in 1767, in a subject whom he had treated for inguinal aneurism, by compression. In the dead body of a patient operated upon by Gavina, in 1775, the iliac artery itself was completely impermeable. It was the same in the case reported by Clarke, and many others, (Voy. Casamajor, *Thèse Cit.*, 1825.) All these proofs, the injections made by Guattani, and those even of Scarpa, which show with what facility liquids thrown into the aorta pass into the arteries of the thigh and leg, though the external iliac had previously been tied tight, were not sufficient, and would probably still have remained a long time without application, in spite of the proposition of Sue, who, according to the statement of M. Paillard, (*Rev. Méd.*, 1829, t. I., p. 18,) had already recommended the ligature of the iliac artery, in the last century,—if necessity had not compelled Abernethy, for the first time, to appeal to them in his behalf, in 1796. An individual, who had already

undergone the operation by the method of Anel, for an aneurism of the popliteal trunk, entered St. Bartholomew's hospital, for an inguinal aneurism on the opposite side. Abernethy (*Journal de Corvisart*, t. XXXI., p. 403) applied the ligature under the crural arch; a hemorrhage, which supervened on the fifteenth day, left him no other resource than to penetrate into the belly, and to perform upon the iliac artery what he had done at first upon the femoral. The patient died, some time after, from a secondary hemorrhage. A second operation was not more fortunate, but a third, performed in 1806, was followed by complete success. To set out from this epoch, it has been no longer possible to call in question the practicability of tying the external iliac without causing mortification of the limb. At present it is one of the common operations in surgery.

M. Freer, in 1806, and M. Tomlinson, in 1807, imitated Abernethy, and like him succeeded. This last named surgeon obtained another successful result in 1809. Out of seven patients, upon whom M. A. Cooper had operated upon up to 1814, four were cured; one died at the end of three months, of an aneurism of the aorta; another of gangrene of the limb; and a third of hemorrhage. Delaporte was the first in France, who, in 1810, ventured to follow in the steps of the English surgeon; his patient died on the twelfth day, with a putrid fever. Goodlad and Dorsey, (V. Mott, *Biographical Memoir*, 1836,) each succeeded once in 1811. In 1812, also, M. Bouchet (*Bull. de la Fac.*, t. IV., p. 173) cured a Spanish prisoner, who died a year after, of an aneurism upon the opposite side. In 1812, moreover, a patient, treated by Albers, was carried off on the twentieth day, by tetanus. An old man of seventy-five years, operated upon by Ramsden, died on the third day. But in 1813, two new fortunate issues were obtained, one by M. Brodie, (*Trans. Med.*, 1828, p. 328,) and the other by Norman, (*Rev. Méd.*, 1820, t. II.) M. Lawrence, in his turn, succeeded in 1814; it was the same with M. Moulaud (*Bullet. de la Faculté*, t. V., p. 584) in 1815. Gangrene, on the contrary, upon the fourth day, deprived M. Collier of a similar triumph, (*Trans. Med.-Chir.*, t. VII., p. 136.) M. Smith—Soden, and Dupuytren (*Bullet. de la Fac.*, t. VI., p. 319. *Leçons*, t. IV., p. 524) were less unfortunate, and each cured a patient in 1815. M. Cole, (*Jour. Gén. de Méd. et de Chir.*, 1818, t. I., p. 96,) in 1817, M. Albert, in 1818, MM. Wilmot, Kirby, Anderson, (*Surg. Anat.* p. 148,) Newbygin, and Post, (*Mott, Biograph. Méd.* p. 18,) each successively obtained a similar success. The patient of M. Salmon (*Fullet. de Férussac*, t. I., p. 87) died on the sixteenth day. M. Wright, (*Ibid.*, t. XVIII., p. 83. *Journal des Progrès*, t. X., p. 247,) M. Richerand, (Pegat, *Thèse* No. 66, Paris, 1837,) Vacca, (*Bulletin de Férussac*, t. I., p. 87,) M. Killian, (*Ibid.*, t. I., p. 450, M. White, (Guthrie, *Opera Citat.*, p. 16,) M. Darcùx, (*Jour. Hebdom.*, t. III, p. 451,) M. Clot, (*Trans. Med.-Chir.*, t. XIII., p. 218,) and many others may now be added to all these names. Delpèch (*Chirurg. Clin.*, t. I.) had not the same fortune; his patient died at the expiration of a few days. M. Tait tied,

successively, on the 8th of May, 1825, and on the 16th of April, 1826, both iliae arteries in the same patient, with entire success, though on one side the peritonœum had been penetrated. M. Arendt, (*Bulletin de Férussac*, t. VIII., p. 80,) who did not leave but eight days of interval between two similar operations on the same individual, was not less fortunate.

I, myself, performed the operation on the 6th of October, 1831; the ligatures came away on the eleventh and thirty-fifth days, and the patient was completely cured. This ease is even more remarkable than any other, in more respects than one. The patient, aged seventeen, tall and strong, while cleaning a table, in a dark part of the room, by accident, ran a carving-knife into his groin, and cut through the external iliac, at three lines above the epigastrie; the blood came out in torrents. MM. Layraud and Durand, (*Jour. Hebd. Univ.*, t. VI., p. 346. *Transact. M. d.*, t. IX., p. 17,) who arrived almost immediately, compressed the artery at two inches above the wound, and thus suspended the hemorrhage while they sent to seek for me. Assisted by these two confrères, as well as by M. Duvivier, I hastened to lay bare the vessel, and to tie it, while they compressed the aorta. No disturbing symptom made its appearance in the limb. The emission of urine, which was difficult on the second day, resumed its function without any inconvenience; symptoms of inflammation about the side caused some apprehensions during a week; the first ligature, placed by means of a curved needle, very high up, in order to allow of an opportunity of examining, with ease, the seat of the wound, did not become detached till the thirty-fifth day; but the wound finally cicatrized, (*s'est mondifiée*,) and the young man is now well. I have seen him many times since, and know that he is in the enjoyment of excellent health. A result like this demonstrates how highly important it is to know how to make compression upon the iliacs and the aorta, through the walls of the belly, and proves, 1, That we may, without the necessity of previous dilatation of the collaterals, effected either by compression, as has been proposed, or by the presence of an aneurism, successfully tie the ilio-crural trunk; 2, That the entire and sudden division of this trunk is not necessarily fatal.

In adding to these cases those which belong to MM. J. Smith, (*Mélang. de Chir. Etrang.*) Guthrie, (*Injuries of Arteries*, 1830,) Sainclair, (*The Lancet*, Aug. 6, 1833—*Gaz. Méd. de Paris*, 1833, p. 634—*Méd. Chir. Rev.* 1833, p. 57,) B. Cooper, (*Trans. Méd.*, Janv., 1832—*Arch. Génér.*, t. XXX., p. 116,) V. Mott, (*Gaz. Méd. de Paris*, 1837, p. 650,) Gibbs, (*London Medical Jour.*, 1827, p. 97,) Liston, (*Edinb. Medical & Surg. Jour.*, vol. XVI., p. 72,) Bujalski, (*Bulletin de Férussac. et Legat. des Princip. Art.*), Salomon, (*Bull. de Férussac*, t. XVI., p. 449,) Lisfranc, (*Archiv. Gén. de Méd.*, 2e série, t. II., p. 514,) Niehet, (*Gaz. Méd. de Paris*, 1833, p. 650,) Morgan, (*The Lancet*, 1828, vol. I., p. 412,) Balingall, (*Ibid.*, p. 618,) Renzi, (*Velpeau, trad. Ital.*, p. 147,) Mirault, (*Acad. Roy. de Méd.*, 136,) Bécлар, (*Clin. Surg.*, 1822,) Baroni, (*Gaz. Méd. de Paris*,

1836, p. 200,) Ruan, (*Ibid.*, p. 742,) Warren, (*Communication Privée*, 1837,) Macfarlan, (*Gaz. Méd. de Paris*, 1837, p. 285,) Anderson, (*Surgical Anatomy*, p. 145,) Hobbart, (*Edinb. Med. & Surg. Jour.*, vol. CXXXVI., p. 84,) and some others, which I have had it in my power to examine, we find already near a hundred; but out of seventy-one, whose results I have ascertained, I perceive there were eighteen deaths, and that fifty-three were cured; that is, one in four. Such a calculation, I know, is too incomplete to justify rigorous conclusions; but it shows, at least, that the ligature upon the external iliac artery, without being generally fatal, is a very dangerous operation.

III. *Treatment*.—Notwithstanding the two examples of cure by refrigerants, moxas and depleting remedies, made known by M. Larrey, and that which M. Reynaud, (*Gaz. Méd. de Paris*, 1837, p. 565,) has since given, the ligature at present should be preferred, in patients who are willing to submit to it, for all cases of inguinal and iliac aneurisms which admit of its application; only we should not forget that, in carrying it beyond three inches into the pelvis, the neighborhood of the hypogastric artery may render it extremely formidable.

A. *The Method of Brasdor*.—Also, unless we should go to the primitive iliac, when the tumor occupies the iliac fossa and there is not sufficient space in the groin to tie the femoral artery above the profunda, it would be allowable to try again the method of Brasdor. The patient of M. A. Cooper did not die till two months after the operation: the pulsations in the tumor, which was enormous, had ceased, and it was not ascertained precisely what had caused his death. That of M. James, who was not more fortunate, had the iliac artery divided into two nearly equal trunks. Nevertheless, the unsuccessful attempt of M. White, though the femoral artery was obliterated below the sac—the continuance of the pulsations still perceptible at the bottom of the wound in the young man whose history I have just related—and the facts related by M. Guthrie, (*Oper. Citat.*, 1837, p. 90,)—do not allow of our placing any very great degree of confidence in this method. To undertake it with any chance of success, it would require that we should be enabled to place the ligature between the tumor and the origin of the epigastric and circumflex arteries of the ilium, or that those branches pushed up by the aneurism should have become filled with clots and rendered impermeable, by the pathological process pointed out in the memoir of M. H. Berard, (*Arch. Gén. de Méd.*, t. XXIII., p. 363.)

B. *Method of Anel*.—Quite a number of modes have been devised to reach the external iliac artery.

I. *Process of Abernethy*.—On the first occasion, Abernethy made an incision of about three inches, in the direction of the vessel above Poupart's ligament. It is this process which M. Bégin (*Dict. de Méd. et de Chir. Prat.*, art. *Aneurisme*,) advises anew. In his second patient, Abernethy, fearful of wounding the epigastric artery, made his incision a little farther to the outside of the

inguinal ring, and gave it a direction slightly oblique from below upwards, in order more easily to avoid the peritoneum.

II. *Process of A. Cooper.*—M. A. Cooper made a semi-lunar incision in the direction of the fibres of the aponeurosis of the external oblique; that is to say, with its convexity downwards, and which took its origin at some distance from the anterior superior spinous process of the ilium, and terminated near the inguinal ring: on raising the semilunar flap thus formed, we perceive the spermatic cord, the opening of the *fascia transversalis*, and the epigastric artery; and in passing the finger under the cord through this last mentioned opening, says the author, we readily come to the iliac vessels.

III. *Process of Norman.*—M. Norman decided upon making his incision in the direction of Poupart's ligament, following in other respects the rules laid down by M. A. Cooper. M. Roux recommends that the incision should commence a little above, and at half an inch only distant from the spine of the ilium, to terminate afterwards upon the middle of the crural arch.

IV. *Process of Bogros.*—Bogros thought that he could advantageously modify the process of Sir A. Cooper, or that of Norman, by advising to make the middle of the incision fall upon the point of Poupart's ligament, which corresponds to the artery, and then to cut down to the opening of the *fascia transversalis*, in order to find with certainty the epigastric artery, which should serve as a guide to lay bare the trunk we wish to tie. M. Mirault, (*Mém. de l'Acad. Roy. de Méd.*, t. VII.,) who was the first that made a successful application of this process upon man, considers it secure, and at the same time very easy.

V. *Process Adopted by the Author.*—This is the one which has appeared to me to be the most simple and the most advantageous, and which I followed in the young man whom I have spoken of above.

a. *First Stage*, (premier temps.) The patient is laid upon his back, with the limb moderately extended. While some of the assistants hold him in this position, others stand ready to serve the surgeon, who, placed on the side of the aneurism, makes an incision, slightly curved, three inches long, parallel with and a little above Poupart's ligament, the middle part of the incision passing on a level with the artery. The first cut of the bistoury goes through the skin, and the sub-cutaneous *fascia*; if the branches of the cutaneous artery bleed so much as to incommode us, we apply the ligature or torsion to it, before proceeding farther. The aponeurosis of the external oblique comes next; for greater security, though not indispensable, it is advisable to pass a grooved sound under it, before dividing it. The fibres of the internal oblique muscle, next present themselves in their turn; those who have a practised hand may divide them, without fear, with the cutting instrument; otherwise we separate their lower portion with the point of the sound, pushing them backward and upward, with some degree of force, while the left fore-finger fixes and retains the lower border of the

wound ; we tear, in the same manner, the *fascia transversalis*, up to the spermatic cord, which is pushed aside in the same direction as the fleshy fibres.

b. *Second Stage.* At this stage, in order to avoid the peritoneum, especially where it is our intention to place the ligature, at a point very high up in the iliac fossa, we make use of the finger instead of the sound ; in other cases this latter has the advantage of isolating the tissues better, and of detaching them less extensively. After that, if the eye does not distinguish the objects, the fore-finger inserted in the wound, whose lips are kept apart, easily recognises the artery upon the inner border of the psoas, and the side of the upper strait. In grasping it, to raise it with two fingers, as Scarpa recommends, and as many practitioners have done, we make useless, and sometimes dangerous lacerations ; it is infinitely better to rupture with the sound the sheath that it receives from the *fascia iliaca*, then to direct the point of this instrument upon its inner side, and detach it from the vein, by cautious movements forward and backward. After this separation, which it is important should be made, to as little extent as possible, but which should comprise the whole circumference of the artery, which latter should be detached, with a great deal of caution, from the iliac vein, and from the nervous branch which creeps upon their surface, we proceed to pass the ligature, either by means of the eyed probe, guided upon the grooved sound, or by the needle of Deschamps, or any other convenient instrument.

c. *Third stage.*—In general, this ligature should be carried rather a little higher up than lower down ; the rule, at least, is to apply it above the epigastric artery, and it is said that Bécларd lost one of his patients from having unintentionally placed it below. It is owing, in fact, to this inconvenience, and to prevent it with greater security, that Bogros recommends that we should seek for the epigastric before occupying ourselves with the iliac. But in proceeding as I have pointed out, when we have laid bare this latter, it is always easy to find the other, and to leave it below the ligature. To prevent either the hemorrhage, or the return of blood, or the continuance of pulsations in the tumor, which may be occasioned by the supra-pubic artery, some persons have thought that, whether wounded or not, we should place the ligature upon this at the same time with that of the iliac. Though this advice may in reality be followed without great inconvenience, practical experience, up to the present time, has shown also that it need not be attended to.

During the progress of the operation, and especially at the conclusion of it, it is of the highest importance that the abdominal muscles should be kept in a state of relaxation, and that the patient should make no effort nor attempt any movement. Otherwise, the intestines would not fail to present themselves at the wound, and the wounding of the peritoneum would be almost inevitable ; and although this lesion, as has been shown by the two cases of

Post and M. Tait, is not as formidable as is generally supposed, we should, nevertheless, do all in our power to prevent it.

VI. *Appreciation.*—The incision vertical or parallel to the artery, and the oblique incisions of Abernethy and M. Roux, present only one advantage, which is that of allowing us to penetrate with less difficulty as high as we wish; an advantage counterbalanced by the greater risk we run of wounding the peritoneum. The lower or inner angle of the wound is the only point which can be dilated to arrive at the vessel: it is, therefore, an unnecessary mutilation to make an extensive division of the walls of the belly.

In the process of M. A. Cooper, modified by Norman and Bogros, or in that which I have given, as the incision crosses the vessel almost at a right angle, it is almost impossible to miss it. It is true an objection is raised that it does not allow us to go sufficiently into the pelvis, and that it exposes, more than any other, to the risk of wounding the epigastric artery. But, on the one hand, we may by means of this incision, go even to the depth of three inches; and if the aneurism is higher up still, it is to the primitive iliac that we must address ourselves, and no longer to the external iliac; while, on the other hand, the tissues being divided layer by layer, and torn rather than cut, as soon as we arrive at the deep aponeurosis, I do not clearly see how we are to wound the epigastric which is behind. However, experience has shown that we may succeed by all these modes; and the mode to be adopted is, as I am aware, much more a matter of choice than one of necessity. Though the transverse incision, however, is always sufficient when the tumor does not extend beyond the crural ligament, it may not, nevertheless, answer our purpose when the disease goes higher still; it is then for the skilful surgeon to make application of the process suitable to each particular case.

VII. *Consequences.*—The blood is carried into the limb after the ligature upon the iliac artery, as after the ligature upon the femoral above the profunda, by means of the gluteal, ischiatic, internal pudic and obturator arteries; and, moreover, by means of the epigastric and circumflex ilii, through their anastomoses with the internal mammary, with the ilio-lumbar artery, and with the lumbar arteries; the proximity of the urinary and genital passages, and of the peritoneum and loose cellular tissue of the iliac or lumbar region, demand all the attention of the practitioner, and the most prompt relief as soon as accidents show themselves in this region; accidents, however, which have nothing special about them, and which are treated by the means generally known.

[*External Iliac.*—Dr. Edward Peace of Philadelphia, tied the external iliac successfully at the Pennsylvania Hospital, Philadelphia, for inguinal aneurism on the right side, July 24th, 1841, on a robust seaman, aged 28 years. The ligature was applied as high up as possible to allow sufficient space for the formation of a coagulum above the epigastric artery. The rapidity of growth of the aneurism, and the subsidence of the temperature of the diseased limb, at first below, and its subsequent augmentation above that of

the other, were noticed in this case as among the usual characteristics of aneurisms in this region. (*Philadelphia Med. Examiner*, New Series, Vol. I, 1842, p. 225—230.)

Up to July, 1844, it is asserted, on good authority, (*Archives Gén. de Med.*, Paris, Juillet, 1844, p. 384.) that the successful application of the ligature upon the external iliac artery, had been performed at Paris only four times, (see also *Séances de l'Acad. Roy. des Sciences*, at Paris, Juin 3, 1844, *Op. cit.*) During that year, M. Malgaigne (*Ib.*) performed it on a young lawyer for a large aneurism in the left groin, which extended as high up as the spine of the ilium. A single ligature only was used, and this came away on the 16th day. At the expiration of about five weeks, the wound was, for the most part, closed, when a rupture of the aneurismal pouch suddenly took place into the wound, destroying the granulations. This accident, however, did not prove serious, as the patient, at the expiration of three months after the amputation, was enabled to resume his pursuits; and at the time the case was given by M. Malgaigne, (June 3d, 1844, above,) his general health was perfect, the left limb being nearly as large and strong as the other, and having nearly the same temperature, though no pulsation was felt in any of its arteries. The incision was nearly vertical, slightly incising towards the umbilicus.

Femoral Aneurism cured by a Ligature upon the External Iliac.—A perfect cure of an aneurism in the femoral artery, by means of a ligature on the external iliac, was effected at the City of Dublin Hospital, (Cormack's *Lond. & Edinb. Monthly Journal of Medical Science*, May, 1843, p. 477; also, *Dublin Journal of Medical Science*, Nov. 1842,) by Dr. Houston on a man aged 26, a card-driver, of somewhat intemperate habits, in June, 1840. The tumor was of a spherical shape, four or five inches in diameter, and situated a little above the middle of the left femoral. The pulsation was diffused in every part, and with a distinct bruit, both of which were completely arrested by pressure over the iliac. There were several dilated veins on the affected side of the abdomen. The motion of the heart was natural. The patient ascribed the tumor to a bruise received about a year before. The operation was performed after the manner of Sir Astley Cooper, and a circumstance was noted worthy of remembrance, that when the tendon of the external oblique muscle was divided, there was a tendency to forcible closure of the wound by this muscle, with every exertion of the body, however trifling. The patient was very unsteady in this case, and at every movement he made, the edges of the divided tendon were drawn, and for a moment hid under the lips of the superficial wound. It was almost impossible to keep them separate by retraction. A curious anomaly was found in a vein lying on the artery as large as the brachial, which, though it has never, Dr. Houston asserts, been noticed by surgeons or anatomists, he has always found present in this situation—being the *internal circumflex ilii vein*. The companion of the artery of the same name, and deriving some branches frequently from the upper part of the thigh,

this vein crosses the iliac artery obliquely, to empty itself into the iliac vein, at a point varying from half an inch to an inch above Poupart's ligament. A portion of the anterior surface of the iliac artery, is therefore, he continues, occupied by the oblique crossing of this vein, at the spot at which it is usual to apply the ligature; and unless the precaution of excluding it be taken, it may, as was near happening in this case, be either wounded or included with the artery in the noose. Therefore it is that Dr. Houston directs the attention of surgeons to this fact. In the case in question, he found, after bringing up his ligature upon the inside of the artery, that it was below the point where this circumflex ilii vein terminates in the iliac vein, while on the outside of the artery the ligature was above the point where that vein had first applied itself to the artery; so that, had the noose been secured, as it thus lay, the vein and artery must have been tied down together by it. The outer end of the ligature was accordingly drawn down from under the circumflex vein before the knot was applied. The patient did well. On the next day, the left foot and leg were somewhat cold, and there was no pulsation in the aneurism, and in the evening of the same day, the temperature of the left ham was two degrees less than in the right. *Six ounces of blood were taken*; but why, the surgeon does not state. On June 26th, there was only one degree of difference in the temperature, and on the 28th, none. The patient was discharged cured on the 25th of the succeeding month.

The very same interruption to the venous trunks in the neighbourhood, which caused regurgitation into, and distension or varicose engorgement or dilatation of the abdominal venous branches on the affected side, probably caused also the unusually large volume of the circumflex, which, from its comparatively insignificant size when normal, most surgeons, though perfectly aware of its anatomical position, have thought it superfluous to mention. Had the case occurred a couple of years later, Dr. Houston would probably have found the knife unnecessary, and adopted the popular mode of compression now so extolled in that capital. T.]

ARTICLE IX.—THE INTERNAL ILIAC (OR HYPOGASTRIC OR PELVIC) ARTERY.

§ I.—*Anatomy.*

In separating itself from the primitive iliac on a level with the sacro-iliac symphysis, the internal iliac (pelvienne) artery immediately abandons the external iliac in order to descend almost perpendicularly into the cavity of the pelvis. Its outer surface is crossed at its origin by the iliac vein, and accompanied in the rest of its course by the hypogastric vein which separates it from the psoas muscle and from the articulation. On its inner side it is united to the peritoneum only by a cellulo-adipose layer which is always very loose; some lymphatic ganglions are also adjacent to

it (lui adossés) in this part. The ureter ordinarily passes above and a little in front of it; on the left the beginning of the rectum lies over it at a greater distance, and its relations with the cœcum on the right are scarcely deserving of notice. We cannot attempt to reach it except from its origin to where it gives off the gluteal, that is to say, to the extent of from one to two inches, in a word, on a line with the great ischiatic notch; the ilio-lumbar which it sometimes gives off in this part, and which then immediately runs outwardly and upward between the psoas muscle and the bones, should also be noted, though the primitive iliac artery or the external iliac, still more frequently perhaps give off this branch.

§ II.—*Indications.*

The trunk of the internal iliac (hypogastrique) artery is too deeply situated to be often the seat of traumatic lesions, and too short to make it necessary that we should treat of the aneurisms with which it might possibly be affected. Sandifort moreover is the only person who relates an example of this kind. It is no longer so with its principal branches. In leaving the pelvis they are still large enough for their wounds or spontaneous rupture to be followed by dangerous hemorrhage; the gluteal artery especially, which terminates as it arrives between the muscles of the same name, and which cannot like the ischiatic and pudic be easily cut down to externally, has many times caused death in this manner. Thédén relates a case of it. In dilating a gun-shot wound the gluteal artery was divided and the unfortunate soldier soon after died. The same thing occurred in consequence of an aneurism in a patient mentioned by Jeffreys, (Scarpa, p. 407.) J. Bell (S. Cooper, *Dictionary*, trad., p. 146) was more fortunate; he saved his patient by applying the ligature to the wounded vessel. M. Ruyer (*Bulletin de Férussac*, t. XXIV., p. 109.—Auger, *Rev. Méd.*, 1832, p. 395) has since published an analogous result, and in the course of the year 1817, M. Brooke (S. Cooper, *Dict. de Chir.*, p. 147) cured, or at least so he thinks, an aneurism in the breech by compression, digitalis and laxatives. But nevertheless it cannot be denied that the ligature upon the artery is the only means upon which we can rely at least in most of the cases of ancient and deep aneurisms.

§ III.—*Operative Process (on the Internal Iliac.)*

This operation was performed for the first time in 1812 by M. Stevens, (*Trans. Med.-Chir.*, Vol. V., or Anderson, *Surgical Anat.*, p. 148,) on a negro female who had an aneurism in her left breech of the size of a child's head, and who recovered perfectly. The woman died ten years after from another disease, and M. A. H. Stevens of New York, informs me that he saw at London the anatomical specimen corroborating the correctness of the assertions of the surgeon of Santa Cruz. However M. R. Owen, (*Bulletin de Férussac*, t. XXVII., p. 162,) who has dissected and preserved the

specimen, says that the aneurism was in the ischiatic artery and not in the gluteal, as had been supposed. On the 12th of May, 1817, M. Atkinson (*Medical and Physical Journal*, Vol. XXXVIII., p. 267) of York repeated the operation of M. Stevens, in the case of a waterman who was found in the same situation as the negress Maila; repeated hemorrhages and an extensive suppuration caused death at the expiration of twenty days. Since then M. P. White (*Journal des Progrès*, t. IX., p. 264) of Hudson, [State of New York,] was more fortunate in the case of a tailor aged sixty years; for the space of a month there was a great deal of suppuration, but the patient finally recovered. M. V. Mott (*Gaz. Méd. de Paris*, 1837, p. 650) who attributes this case to M. Samuel White, says moreover that the internal iliac artery had already been tied successfully in Russia; but I have not as yet been enabled to procure any details of the case. On the other hand I am happy in having it in my power to add that M. V. Mott (*Gaz. Méd. de Paris*, 1837, p. 530-550. Hosack, *Archiv. Gén.*, 1837) himself has performed this important operation with entire success, though he had opened into the peritoneum in endeavoring to lay bare the artery.

A. *M. Stevens* first divided the integuments, aponeurosis and muscles to the extent of five inches, a little to the outside and in the direction of the epigastric artery. After having detached the peritoneum by pushing it inwardly, from the *spine* of the ilium to the division of the primitive iliac artery, he isolated the hypogastric trunk with his fore-finger; he then applied the ligature upon it at the distance of half an inch below its origin.

B. *M. Atkinson* adopted the same method; but the blood flowed so abundantly that he was obliged to introduce his whole hand into the iliac fossa to enable him to reach and tie the artery.

C. *M. P. White* made upon the side of the abdomen a semilunar incision, seven inches long, with its convexity turned towards the ilium, and which commenced in the neighborhood of the umbilicus and terminated near the inguinal ring. After having thus divided the whole thickness of the walls of the belly, tied some arteries, and detached the peritoneum, he raised the trunk of the internal iliac with the handle of his scalpel in order to tie it at an inch below its origin, and afterwards used sutures and adhesive plasters to unite the wound.

D. As this operation is performed upon *sound parts* far from the disease, it is easy to practise it upon the dead body, and to assure ourselves that an incision of five inches, as M. Stevens made it, is sufficient—even preferable to that recommended by M. P. White, since it enables us to avoid all the branches of the epigastric, without our incurring the risk of wounding the anterior iliac artery.

E. *Process of the Author*.—We should succeed full as well, in my opinion, by prolonging to two inches farther, the outer extremity of the incision, recommended by M. A. Cooper, for the ligature upon the external iliac artery. It is the process which M. Anderson (*Surgical Anatomy, etc.*, 1822, p. 145,) prefers, in order, he says, the more easily to avoid the peritoneum and to prevent the con-

secutive hernia, which took place in a patient of Kirby, (*Ibid.*, p. 148,) as well as in that of M. Stevens, according to M. Scott, (*Ibid.*, p. 149,) who noticed it also after an operation by himself. But we do not see how the incision of Abernethy would protect us better from this inconvenience than any other incision.

In whatever manner made, we should guard ourselves against attenuating (*amincir*) or denuding the peritoneum too much while detaching it with the fore-finger. Having arrived upon the inner border of the *psoas*, we should make use of the fore-finger to separate the artery from the very large (*enorme*) veins which it partially conceals. We depress (*incliner*) its root, as well as that of the external iliac downward and towards the centre of the pelvis; then, by means of the needle of Deschamps or the S shaped needle of M. Caussé, or a flexible sound having an eye near its point, we pass the ligature. The greatest degree of precaution is here necessary; the venous trunks must be respected with care; their walls are thin, and nothing is more easy than to tear them. In displacing the artery, we may rupture the ilio-lumbar, and bring on a dangerous hemorrhage, (*épanchement*.)

F. *Consequences of the Operation.*—The ligature in question, so formidable at first sight, is less serious in reality as to its influence upon the circulation than that upon the external iliac or the femoral only. In fact it leaves intact all the appropriate vessels of the corresponding limb, and the two internal iliac arteries communicate with one another by anastomoses so large and numerous, that after the obliteration of the one the blood must be readily carried by the other to the viscera which they nourish. But it is dangerous in another sense; first from the difficulties themselves attendant upon the operation, and secondly from the dissections (*décollements*) which must unavoidably be made in the midst of an extensive cellular tissue where inflammation and suppuration are readily propagated to a great distance.

ARTICLE X.—THE GLUTEAL ARTERY.

If the obliteration of the hypogastric artery has the advantage of curing irrespectively all aneurisms of the breech, whatever may be the artery wounded, its manipulation is, in fact, so fearful that we should be fortunate were we enabled to substitute for it the ligature upon the diseased artery itself. Now this appears to me practicable where we are treating a diffused or a circumscribed aneurism, or a traumatic or a spontaneous aneurism, so often as the diseased portion of the artery is in the breech. In fact the gluteal artery on leaving the pelvis lies naked upon the anterior and superior border of the great ischiatic notch, so that were we obliged to open the tumor before reaching the origin (*racine*) of the vessel, it would still be a thousand times preferable to the ligature upon the internal iliac artery. There it would be easy to compress it and to cauterize it, and close it with the end of the finger. Nothing would prevent us at first from introducing a conical gum-elastic bougie into the

wounded artery, to arrest the blood and raise up the vessel until we should pass a ligature around it.

Many surgeons, moreover, had already put these precepts into practice, so that the ligature upon the gluteal artery is no longer a new operation. Muzell (Rougemont, *Chirurg. du Nord*, p. 377,) speaks of a practitioner who had performed it with success towards the middle of the last century, on the occasion of a wound in the breech. It has been performed since, and with like success, by M. Carmichael, (*Gaz. Méd. de Paris*,) for a false consecutive aneurism. A patient operated upon in the same manner by M. Murray (*ibid.*) for a diffused aneurism, succumbed. The same ligature applied to arrest a hemorrhage in the breech, by M. Baroni, (*Ibid.*, 1835, p. 695,) has, on the contrary, succeeded perfectly.

Operative Process.—In the case of a recent wound the best plan would be to incise and dilate largely, in order to come down upon the opening of the artery, and to reach it at the bottom of the wound. If it proved difficult to seize hold of it with the forceps, we might relieve ourselves of embarrassment by transfixing (en embrochant) it with the elastic rod (baguette) of which I have spoken. Thus closed and held, it would allow of being isolated and tied without any trouble. For a systematic process, applicable to cases of aneurisms properly so called, I know of none more exact or more easy than that of M. Lizars or M. Robert.

Surgeons who have described or performed the operation of the ligature upon the gluteal artery, have limited themselves, says M. Robert to recommending an incision parallel with the fibres of the gluteus maximus muscle. This want of precision, taken in connection with the extremely deep position of the vessel, has rendered the operation one of the most difficult that are performed. We arrive at something better by basing the operative process upon exact principles of surgical anatomy. Now, the point from which the gluteal artery leaves the pelvis in turning round upon the upper border of the ischiatic notch, is situated just at the middle of a line drawn from the postero-superior spinous process of the ilium to the apex of the great trochanter.

The patient being laid upon his belly, the surgeon first ascertains the position of the two bony projections which I have just named, and which is always practicable, seeing what little thickness there is in the soft parts which cover them. He then makes in the direction indicated an incision of from four to five inches in length, an incision which is then parallel to the fibres of the gluteus maximus. Setting out from thence the operator immediately passes his finger into the wound to identify the position of the bony border, against which in a case of necessity he might compress the artery if the violence of the hemorrhage should satisfy him that it was necessary. Separating finally the pyriform and gluteus medius muscles, whose approximated borders conceal the gluteal artery, there remains nothing more than to isolate the vessel and to surround it with a ligature.

If the transverse section of any muscular bundles would lessen

the difficulties, we should decide upon doing it without any hesitation. The almost utter impossibility of obtaining an immediate reunion in such cases, and the danger of seeing the pus or inflammation extend into the pelvis would induce me to fill all the incisions with lint and not to attempt to cicatrize the wound but by second intention.

[LESIONS OF THE GLUTEAL AND ISCHIATIC ARTERIES, AND THE APPLICATION OF A LIGATURE UPON THEM FOR WOUNDS, ANEURISMS, &c.]

M. F. Bouisson one of the Professors of the Faculty of Medicine at Montpellier has recently in an interesting memoir (*Mémoire sur les Lésions des Artères Fessière et Ischiatique, et sur les Opérations qui leur conviennent*, in the Gaz. Méd. de Paris, t. XIII., No. 11, p. 162, et seq., Mars 15, 1845 ; Mars 22, 1845, p. 180, et seq., and Mars 29, 1845, p. 195, &c.) called the attention of practitioners to the subject of wounds of the gluteal and ischiatic arteries, which he thinks has been much neglected, from an impression in his opinion quite erroneous, that these deep-seated anatomical relations present almost insuperable obstacles to the application of the ligature to their trunks in wounds, aneurisms, &c. The Professor of Montpellier, considers that the emulous impulse created by the ligature successfully applied by Abernethy upon the external iliac excited the ambition and attention of surgeons, to direct their efforts upon still larger trunks in the splanchnic cavities ; a ligature upon the hypogastric for example, or even upon the common iliac for aneurisms in the gluteal region, which might have been relieved by confining the operation to the sound portion of the vessels themselves, implicated, rather than by undertaking the hazardous experiment of opening into the pelvis for the trunk of the common iliac, which is so variable in its length and divisions.

M. Bouisson having made the gluteal and ischiatic arteries the subject of particular researches, we avail ourselves of his valuable remarks on their anatomical and surgical relations.

Anatomy.—The arterial vessels of the gluteal region arise from the hypogastric or internal iliac, emerge from the pelvis through the ischiatic notch ; and are two in number, viz., the gluteal and ischiatic. The trunk of the internal pudic (*honteuse interne*,) does not belong to this region, but in a manner so to speak accidentally. In the erratic course described by this vessel, it makes a sort of demonstration (*une sorte d'apparition*) of passing out of the pelvis, but soon re-enters it. The gluteal and ischiatic are in an inverse relation to each other in size, a law which M. Bouisson has constantly observed in the prepared pelvis submitted to his inspection. Thus if the ischiatic is larger than usual, the gluteal is less, &c. ; the gluteal however being the largest of the two in nine cases out of ten—its calibre being usually double that of the ischiatic—thus the gluteal has six millimetres before its division, while the ischiatic at its point of emergence has but three. Hence the greater size of the gluteal makes it the most liable of the two to aneurisms. These two arteries of the gluteal region constitute inferiorly the limits of

the hypogastric region; one situated on its posterior plane curves in such manner as to present its concavity backwards; passes between the lumbo-sacral nerve and the first nerve of the sacrum, and emerges from the pelvis at the most elevated part of the ischiatic notch, between the pyriformis muscle, and the border of the bone; this is the *gluteal* or *posterior iliac*; the other seems to retain the primitive direction of the principal trunk, undergoing considerable diminution from the numerous branches which it gives off; it directs its course downwards and issues from the pelvis underneath the pyriform muscle, between that muscle and the gemellus superior; this is the *ischiatric* or *inferior iliac*.

Three portions of both these arteries are to be distinctly noticed: 1st, the intra-pelvic; 2nd, the point of emergence; 3rd, the extra-pelvic.

1. The gluteal in its *intra-pelvic* portion has a very short trunk, for it proceeds immediately downwards, backwards and outwards to reach the ischiatic notch. Besides its connection here with the lumbo-sacral and first sacral nerves, as above stated, it is accompanied by the gluteal vein which is situated in front of it, while the gluteal nerve is upon its inner side. The peritoneum only indirectly covers these organs; being separated from them by the cellular tissue which becomes more and more condensed in proportion to its proximity to the ischiatic notch. At this last point it forms a sort of arcade or semicircular ring (*anneau cintré*), the concavity of which embraces the vasculo-nervous bundle, and the extremities of which attaching themselves to the osseous portion of the ischiatic notch, thereby form a complete ring. The fibro-cellulous portion of this ring does not offer the same resistance in all persons; it marks the termination of a sort of passage which might be called the *gluteal canal*, from whence protrude the viscera in *ischiatric hernia*. The gluteal artery furnishes muscular branches, and in certain cases gives origin to the ilio-lumbar, the sacro-lateral (*sacrée latérale*), and the middle hemorrhoidal (*l'hémorrhoidale moyenne*). We have seen it, says M. Bouisson, give off the internal pudic, and the ischiatic itself.

The *point of emergence* of the gluteal artery, corresponds nearly to the middle of the curvature of the great ischiatic notch. It is important to know the precise situation of this point, *because it is the only one where the trunk of the gluteal artery can receive a ligature*. Therefore it is that the professor of Montpellier has determined the following relations of the external projecting portions of the pelvis to this point, and which he gives as the result of a particular examination of many pelves on which the arteries were prepared by desiccation:—

<i>Pelvis of an adult man.</i>	<i>Right side.</i>	<i>Left side.</i>
Distance from the point of emergence to the anterior superior spinous process of the ilium,	11 centimet. 11½	11 10½ 11½
“ the posterior, “	6 “ 6	6 6 7
“ the most elevated part of the crest of the ilium, “	10 “ 10	10 9 10

<i>Pelvis of an adult woman.</i>	<i>Right side.</i>	<i>Left side.</i>	<i>Both sides.</i>
Distance from the point of emergence to the anterior superior spinous process of the ilium,	10½ cent.	10½ 10	11
“ the posterior “ “	6	7 6	7
“ the most elevated part of the crest of the ilium,	9	9 9	9

It results from these measurements that the gluteal artery observes a sufficiently constant position in its point of emergence from the pelvis, and that its relations with the projecting processes of the pelvic border, differ but little in men and women, so that we may almost with certainty know where to cut down upon the arterial trunk to seize and tie it. The gluteal artery outside of the ischiatic notch, has but an inconsiderable extent—ordinarily not over five millimeters (millimètres) before dividing itself suddenly into its terminating branches; sometimes it terminates on a line with the osseous border of the notch. M. Bouisson however, has seen two specimens at the Museum of the Faculty, (at Montpellier,) in which it did not divide till at the distance of two centimetres beyond the ischiatic notch. These variations have an important bearing on the application of the ligature to the vessel, whose depth at this point depends upon the embonpoint of the subject. When the trunk divides only at a certain distance from the osseous border it may be seized without difficulty; but the operation becomes much more laborious if it does not go beyond the thickness of the bone of the ilium on a line with the notch. Nevertheless it is always accessible, and M. Bouisson has never seen it give off its terminating branches in the interior of the pelvis. In one case only he has seen the gluteal artery, give independently of its terminal branches, a branch of considerable size, which originated on a line with the pyriform muscle, passing just behind and then under this muscle, from whence it emerged outwards to be distributed to the external organs of the pelvis.

At its point of emergence the posterior iliac artery is covered by the gluteus maximus muscle, a cellular fascia of considerable density being interposed between them. The gluteal vein is not constant in its relations to the artery; but the Professor has generally observed that it is situated behind, and on its inner side; its trunk continues in the latter direction, passes around the artery and takes a definitive position in the interior of the pelvis, where it is situated in front of it. This vein sometimes, does not properly speaking, become a trunk until within the pelvis, so that on a line with the extra-pelvic portion of the artery, it consists only of tributary branches of moderate size, whose lesion would be of no consequence in applying the ligature to the artery. The superior gluteal nerve, which comes from the lumbosacral, is on the inner and posterior side of the artery.

The gluteal artery, in its *extra-pelvic* portion, divides into two principal branches, which separate on a line with the posterior

border of the gluteus minimus muscle; one is superficial, the other deep-seated.

The first proceeds outwards, in the interspace between the gluteus maximus and the gluteus medius muscles, and distributes itself by numerous branches into the thickness of these muscles and the tissues in their neighbourhood. Some of these branches anastomose with those of the ischiatic artery. The deep-seated branch divides from behind forwards, between the gluteus medius and minimus muscles; it supplies a small nourishing artery to the bone of the ilium, and then soon divides again into three secondary branches, the superior of which describes a course parallel with the superior border of the gluteus minimus muscle; the second more voluminous, crosses the track of this muscle, from which it is separated by an adipose layer of greater or less extent, and then directs itself towards the great trochanter; the third goes obliquely downwards and distributes itself upon the capsule of the ilio-femoral articulation. These different branches, whose numbers may vary, furnish branches which penetrate into the glutei muscles, where they anastomose with each other, and with those of the ischiatic. Beyond the limits of the gluteal region they anastomose with the divisions of the internal circumflex iliac, or with those of the external circumflex iliac of the thigh, so that the obliteration of the gluteal trunk in no respect endangers the nutrition of these parts. The branches of the posterior iliac artery in these terminations are, it is to be observed, *more or less perpendicular to the direction of the fibres of the gluteus maximus muscle*, a circumstance which should be taken into consideration for the choice of the direction to be given to the incision, when we wish to cut down upon the gluteal artery.

2. The ischiatic artery considered in its *intra-pelvic* portion, is a continuation of the trunk of the internal iliac, supplies some small branches to the muscles and organs of the lower pelvis (*petit bassin*), descends backwards and upon the sides of the rectum, and issues from the pelvis at one of the openings (*intervalles*) of the sacral plexus (*plexus sacré*.)

At its *point of emergence* which takes place at the lower part of the ischiatic notch, it is situated between the pyriform muscle and the small sacro-sciatic ligament, at three centimeters below the gluteal artery, on a plane more internal, and in the direction of a line from the posterior superior spinous process of the ilium to the tuberosity of the ischium. At this same point the artery is situated upon the inner and posterior side of the great sciatic nerve; the corresponding vein is upon the posterior and inner side of the artery, and partially (*tend*) turns round it to take a position in front of it in the pelvis. In this manner the *ischiatic artery is situated between its corresponding nerve and vein*, relations sufficiently constant, and which must not be lost sight of in the ligature upon this vessel. The internal pudic which arises frequently from a trunk common to it and the ischiatic, and which Harrison has even seen furnished by the latter externally, is situated in front of it and upon

its inner side, but soon leaves it to return into the pelvis. These different organs are united by dense cellular tissue, and covered by the glutens maximus muscle.

The trunk of the ischiatic artery *externally* to the pelvic cavity, has but little extent; it almost immediately gives off branches which proceed in opposite directions: one terminating near the os coccygis furnishes small branches to the coccygeus and levator ani muscles; the other destined to the glutens maximus, passes outwards and distributes itself to the inferior third of this muscle in the cellular tissue which surrounds the tuberosity of the ischium, and furnishes also a small branch which goes to the fossa of the trochanter to supply the muscles of this region. The third descends to the posterior part of the thigh, accompanying the sciatic nerve which receives in its substance some of its small branches. The ischiatic, in its terminating branches, anastomoses with the circumflex of the thigh and the perforating arteries, so that it establishes communications between the hypogastric and femoral (crurale) arteries. These anastomosing resources re-establish the circulation interrupted by the ligature upon either one of these vessels, but especially upon the last. In these cases the divisions of the ischiatic are dilated to a remarkable degree. Boyer (*Traité des Malad. Chirurg.*, etc., t. II., p. 73, 4e edit.) says he has seen in a case where the femoral was obliterated for a popliteal aneurism, the divisions of the ischiatic so much dilated, that the small artery which penetrates into the sciatic nerve had acquired the size of the radial.

Wounds of the Gluteal and Ischiatic Arteries.

The shortness of their trunks external to the pelvis, their deep seated position, and the remarkable protection they receive from their situation on the posterior part of the body, and the thick masses of muscle and other tissue which cover them, and the projections of the solid bones of the pelvis by which they are surrounded, are the reasons why they are so seldom wounded. This does however happen from falls, surgical operations in those regions, and especially from fire-arms. According to Theden death was the consequence of wounding the gluteal during a surgical operation. Guthrie relates the case of Colonel Macpherson in whom death was thus produced, by extensive hemorrhage from the gluteal wounded by a ball in the hip, and which diffused aneurism might have been prevented by a timely ligature on the trunk.

Wounds of the arteries of the gluteal region may cause diffused false aneurism, circumscribed false aneurism or aneurismal varix.

External hemorrhage is rare, as M. Bonisson remarks, if the wound does not extend deeper than the external portion of the glutens maximus, and is easily arrested by compression. If the wound however goes through this muscle, even the trunks themselves may be divided and produce a copious hemorrhage. The anatomical relations indicate to the surgeon what mischief the wound has made. If the wound corresponds to the inferior third

of the gluteus maximus, it is to be presumed that the ischiatic artery or its branches have been divided. As the hemorrhage from this artery, owing to its smaller size, is less serious, compression may generally be relied upon, the small sacro-sciatic ligament behind it offering also an excellent point d'appui for pressure. If the wound is below and on the inner side of the sacro-sciatic spine, it may be presumed that the internal pudic is injured, and here compression is still more effective upon this bony prominence which Travers (vid. Harrison on the *Surgical Anatomy of the Arteries*, Vol. II.) used in a desperate case with great success.

If the wound corresponds to the upper half of the gluteus maximus muscle, and especially if on a line with the osseous border of the ischiatic notch, the branches of the gluteal artery or the trunk itself may be implicated if the instrument has penetrated deep, and the injuries to which are so much the more dangerous because this trunk being very short and lying under the ischiatic notch, affords no point d'appui for pressure. The hot iron may be used but the ligature is to be preferred.

M. Bonisson relates in practical illustration of his valuable memoir, the case of a woman aged about 40, who on May 31, 1842, received three severe wounds in this region from a shoemaker's knife inflicted by her husband. The surgeon called in soon after and found her bathed in blood, pale and exhausted. On the middle part of the left gluteal region he discovered a wound of three centimeters in length and still greater depth, from which arterial blood freely issued. Hastening to sponge the bottom of the wound he soon reached the gluteal artery which was found to have been divided near the bony border of the ischiatic notch: a ligature was applied to it and the hemorrhage ceased immediately. The lips of the wound were brought together by adhesive plasters, and the whole supported by a compressing bandage. The other two wounds were found to be of no importance. The patient however continued greatly exhausted for six days, when by means of stimulating treatment reaction took place and the parts soon after cicatrized perfectly, the ligature coming away on the 8th day. An acute pain however was now felt at the lower angle of the wound, and radiating from thence in the course of the sciatic nerve and its divisions, gave reason to fear that the trunk of this nerve or its branches had been wounded. On the 12th day this pain was so intense as to deprive the patient of rest, and to excite a high fever and involuntary retraction of the limb of the affected side, indicative of traumatic neuritis. Acetate of morphine alone relieved the intense suffering, and in a month she walked about perfectly restored.

Death would have undoubtedly ensued, he thinks, in this meagre subject, with an open, unobstructed wound, had not timely assistance arrived; the smoothness of the track made by the sharp instrument, facilitated the application of the ligature which was placed around the artery immediately above the division of the trunk, the latter having been wounded precisely at the point where it is about

to give off its terminal branches. A single ligature with the forceps and tenaculum sufficed for the operation. M. Bonisson thinks the forceps of MM. Jules Cloquet, and Colombat, and which have been called *pincers-ports-ligature* (or ligature-forceps) might be used with advantage.

Among the accidents that may ensue from the application of ligatures in these regions, says M. Bonisson, we may mention abscesses, or if only one ligature is used, the re-establishment of the hemorrhage from the free anastomoses of the branches of the gluteal with one another, or with the ischiatic itself, which last accident makes it advisable to apply a ligature on each end of the cut vessel.

In illustration of this, M. Bonisson cites the case of Professor Baroni, of Bologna, (*Bulletino delle Scienze Mediche*, 1835,) where a peasant, aged 22 years, falling from a tree, struck his right gluteal region upon his sickle, making a deep wound on the inferior portion of the gluteus maximus, and exposing the sacro-sciatic ligaments and the os innominata. The hemorrhage was soon arrested, and the wound healed by first intention. But in a few days fever supervened, and a collection of pus formed, which was evacuated, but followed on the fourteenth day by two successive and dangerous hemorrhages. Though these were suspended by compression, M. Baroni deemed it advisable to lay bare the wounded trunk, upon each of the cut extremities of which vessel a ligature was readily applied, and the hemorrhage definitively arrested.

Diffused Hemorrhagial Tumor.—There is no artery, according to M. Bonisson, whose lesion more frequently leads to the formation of false primitive aneurism, than the gluteal. The depth of the vessel, its volume, and the impossibility of making exact pressure upon it, together with the arrangement of the muscular layers, all concur simultaneously in facilitating the infiltration of the blood, and its reunion into a vast collection. Should there be ever so little difficulty for the blood to make its escape outwardly, by reason of the narrowness or obliquity of the wound, or those two circumstances united, it insinuates itself under the gluteus maximus muscle, which it gradually raises up so as to form sometimes a tumor of immense size. The Professor of Montpellier gives to Jno. Bell the credit (*Trait. des Plaies*, trad. du Professeur Estor, p. 105, et suiv.) of having been the first to point out, in a clear manner, the danger of the hemorrhage, and the difficulties of the operation for this false aneurism in the gluteal artery. He thinks, however, that the illustrious English surgeon has somewhat exaggerated the danger of the operation, and that, if prompt surgical means were immediately had recourse to in wounds of this artery, the hemorrhage would rarely accumulate to the enormous quantity of *eight pounds of blood*, which Bell asserts it sometimes does; nor would the operation, if performed in time, require the frightful incision of two feet, which that surgeon made in one case, and which necessarily endangers the exfoliation of the ilium.

False Circumscribed Aneurism.—However favorable the arrange-

ment of the tissues on this part are to extensive effusion of the blood, compression properly made will, by bringing the layers of these tissues into closer contact, prevent the hemorrhage from diffusing itself into their interstices, and thus frequently establish limits to its progress, and give rise to the formation of a sort of aneurismal sac. A pulsation will then be perceptible to the hand and ear, and a peculiar bruit synchronous with the dilatation (or expansion) of the tumor. As an example, he quotes a case of this kind: Master West, aged 17, operated upon and cured by M. R. Carmichael, in 1833, (See *Gaz. Méd.*, 1834; *Dublin Journal*, &c.) From the success of this case by M. Carmichael, M. Bonisson dates the reception of the operation of a ligature on the gluteal as one that has been recognised as practicable. In pointing out the fact, however, that the development of the tumor proceeds to so much greater extent downwards than in any other direction, and that the artery may be left accessible at only half an inch depth from the surface of the integuments, he deduces therefrom, as it appears to us, a valuable argument in favor of a transverse incision on a level with the border of the ischiatic notch, in preference to making it, as M. Carmichael did, in a direction parallel with the fibres of the gluteus maximus muscle; for, in the former case, M. Bouisson has frequently ascertained on the dead body, that we may easily avoid opening into the sac, and crowd it, in fact, downwards and out of our way, while in the latter we can scarcely escape from penetrating into the tumor, and thus recurring to the ancient process, obviously he might have remarked, more dangerous at this artery, because of the impossibility of making pressure upon the vessel on the cardinal side of the tumor.

Varicose Aneurism, (Anéurisme Variqueux.) The position of the gluteal vein being closely united with, and more superficial than that of the artery, favors, of course, the production also of a varicose aneurism. [For this kind of aneurism, see the excellent practical observations of M. A. Bérard, in our note under the Veins. T.] Generally, this vein, which in some persons is of considerable size, is found on the posterior and inner side of the artery, so that it may possibly be wounded by the instrument if we penetrate to any depth. In a subject upon which he was making experiments with the ligature, he accidentally met with a *varicose dilatation* of the gluteal vein of the size of a nut, and completely covering the artery, so that the vein would necessarily have had to be wounded in tying the artery.

The *ischiatric artery* may also be subject to the forms of aneurism described, and also to an *aneurismal varix*, (une varice anéurismale,) as shown in the following case, described by Professor Ribéri, of Turin: (*Gaz. Méd. de Paris*, 1838:)—A peasant, aged 25, was wounded in the year 1832, by a small sickle on the right breech, opposite the ischiatic notch, and on the track of the ischiatic artery. The hemorrhage was arrested by compression, and in fourteen days the wound perfectly cicatrized, but left a pulsation in the part, with pain in walking, and gradual enlargement of that breech,

which obliged him to enter the hospital a year after. This breech was a third larger than the other. When placing the finger on the cicatrix and on the osseous border of the notch, at some lines within this opening, a distinct pulsation was felt to the extent of three or four lines; and also obscure diffused pulsations throughout the whole of the breech, with a sensation of murmur (*fremissement*) and tremor, (*tremblement*), both radiating from the notch. Two venesections, ice to the part, and compression by the tourniquet, in three months dissipated the pain, the tumor, and the pulsations, except that the latter were still felt at the cicatrix. Pressure was applied directly to this part, and the patient returned home and remained there three years. In the summer of 1838, the patient returned to the Clinique with the tumor and pulsations to the same extent as at first, but without pain, and complaining only of a numbness of the limb. Compression was had recourse to by means of a truss and suitable pelote, and relief again obtained when the patient left the hospital, without being operated upon.

This case is briefly alluded to by M. Velpeau, (p. LVI. of the Appendix prepared to Vol. I. of this work; *vid.*), as undoubtedly one of aneurism proper of the artery itself; but as it did not reach M. Velpeau until the text of his work was put to the press, we have thought it advisable to insert the details in this place.

The term *varice aneurismale*, which is the phrase made use of in the case as reported in the *Gaz. Médicale* of Paris, 1838, means, or should mean, as will be seen by a reference to our note already alluded to on M. A. Bérard's paper, (see under Veins, *infra.*) quite a different thing; though it is undoubtedly understood by M. Bouisson, as we see by the caption above, under which he places it, to mean *varicose aneurism*.

The contradictory use of these phrases leads to much confusion and to errors, which would not happen if authors were as explicit and lucid in defining the true surgical anatomy of parts as M. A. Bérard has been.

Spontaneous Aneurisms of the Gluteal and Ischiatic Arteries.—M. Bouisson has seen *six* cases of these, four on the left and two on the right breech. The causes are obscure—sometimes they occur without any apparent cause, at other times from contusions or from the efforts made in evacuations by stool. Their progress is slow, especially when all the coats of the artery have not been simultaneously injured to the same extent. It is often some time before the patient himself is aware of their existence; which is finally disclosed by a circumscribed pulsative tumor under the skin in the middle of the gluteal region. Then follows pain in the part, with numbness and difficulty of motion in the lower extremity on the side diseased, in consequence of the pressure made by the tumor on the sciatic (*sciatique*) nerve. The tumor may remain stationary for years, as occurred in a physician whose case was communicated to M. Bonisson by his colleague, M. Dubrueil. At other times, they go on increasing until they end in death, by the usual termination of all aneurisms in rupture, or death may ensue from the

interference which the pressure of the tumor causes with the innervation and nutrition of the limb.

The diagnosis is exceedingly obscure when the tumor is not large, because it is next to impossible to make behind the tumor pressure of the short trunks of the arteries in question, against any firm support; while no satisfactory information can be obtained by compression of the capillary circulation on the distal side, because the arterial trunks in question break up so rapidly in their minute distribution. From the proximity of the two trunks also, an aneurism of the gluteal artery has, he thinks, in two instances, been mistaken for an aneurism of the ischiatic, one that of M. Stevens, the other M. Ruyers. This error, however, proved of no importance in a case where the hypogastric artery was tied. A cystous or an erectile tumor also, situated over these trunks, and receiving their pulsations, may also erroneously lead to the supposition that an aneurism exists. So, also, an abscess slowly formed in this region, may cause a similar error; while, on the other hand, a true aneurism may be mistaken for an abscess, as noticed in the case by White, where the aneurism, being opened, discharged a pint of blood, and rendered it necessary to place a ligature on the internal iliac. The Journals mention a recent case, (*Ann. de la Chir. Franç. et Etrang.*, Mai, 1843, p. 116,) where an eminent surgeon of London tied the primitive iliac in a patient who was supposed to have gluteal aneurism; but in whom death, which took place eight months after, disclosed the fact that it was an encephaloid tumor.

M. Bouisson furnishes, in illustration of his remarks, the two following interesting cases which have recently occurred under his own observation:—

1. *Aneurism of the Left Gluteal Artery cured spontaneously.—Autopsy.*—This case was that of a woman who died at the *Maison Centrale*, at Montpellier, in the winter of 1842. No particulars could be obtained of the previous condition of the patient. Externally, there was no cicatrix or appearance of aneurismal tumor in the gluteal region in question. The embonpoint of the patient may, in part, have concealed any appearance of tumor. Upon injecting the arteries of this patient, a circumscribed aneurismal tumor, in the course of the dissection, was found upon the extra-pelvic portion of the gluteal artery. It was of the size of a pullet's egg, flattened a little from before backwards, in the direction of the pyriform (pyramidal) muscle, and sacro-sciatic ligaments, which it covered. Its base was situated downwards, while above it was attached by a pedicle of a centimeter in diameter, to the extremity of the trunk of the gluteal artery, at the point where this vessel furnishes the terminal branches which are distributed to the muscles of that region. The gluteal artery itself was of considerable size, and extended two centimeters, at least, beyond the upper border of the ischiatic notch; so that it might have readily been included in a ligature, if the progress of the aneurism had rendered an operation necessary.

The tumor evidently showed that it was an aneurism which had

been cured spontaneously. The walls of the sac were thickened, and contained here and there cartilaginous plates or calcareous granulations. The narrow portion by which it was adherent to the arterial trunk, was plugged up by clots of blood and organized lymph; nevertheless, the artery itself was not only not obliterated at this point, but on the contrary dilated, as were also the branches which were given off from it. The branches of the gluteal artery were, in fact, in that remarkable condition described by M. Breschet, under the name of *cirsoïd* (cirsoïde) *dilatation*, or arterial varix, (varice arterielle.) The obstruction in the neck of the aneurism was so complete, that the injection which distended the trunk and the divisions of the gluteal, had in no degree penetrated into the cavity of the tumor. In opening this latter, M. Bouisson found it completely filled with fibrinous layers, (couches fibrineuses) still retaining the color of the blood, but with appearances of a new organization, which had acquired considerable density, and presented very evident osseous granulations. The surrounding organs were normal, and the hypogastric artery had its usual arrangement.

This case, M. Bouisson remarks, presents the rare instance of the spontaneous cure of an aneurism, without obliteration of its connecting arterial trunk; which result, in this case, he thinks was owing to the tumor being turned downwards, and making no pressure on the terminal branches of the gluteal artery. In one part, the tumor appeared to be flattened and compressed between the gluteus maximus muscle and the organs which fill up the space of the ischiatic notch, (l'échancrure iliaque,) which compression between the two layers, one muscular, and the other fibrous layers, contributed, M. Bouisson thinks, to the spontaneous cure.

The pathological arrangement of the parts here also shows the preference which should be given to the transverse incision, had an operation been required.

2. The other case was that of M. Ruyet, already mentioned, where an aneurism of the *left ischiatic* artery was mistaken for one of the gluteal. As this was published in the *Revue Médicale*, 1832, and is known to the profession, we shall briefly state that it occurred from contusions in a woman of robust constitution, aged 66.

This neglected case, finally, after years of suffering, terminated in death in 1826. The tumor had acquired an immense size, being 21 inches in circumference, and filled with blood and pus. Its pressure had almost totally destroyed the three glutei muscles. The primitive iliac had here and there traces of ossific matter. The gluteal artery lay in its natural position at the bottom of this vast cavern, where its calibre was so enlarged as to admit the index finger, while the walls of the extra-pelvic portion of this trunk at an inch outside the pelvis were healthy. The artery is supposed in reality to have been the ischiatic.

M. Bouisson, after reviewing the four well-known cases of ligature upon the hypogastric or internal iliac artery for aneurisms in the gluteal region, by Messrs. Stevens, Atkinson, Pomeroy White and Mott, gives it as his decided opinion in accordance with our

author, M. Velpeau, (in the text above,) that notwithstanding the successful issue in three of the cases out of the four, the operation is of too hazardous a nature to be repeated.

Among other objections connected with this operation, such as peritoneal inflammation, and abscesses in the pelvic cavity, he mentions also the anomalies which particularly characterize the course and distribution of this artery, as is noted by Meckel, (*Manuel d'Anat. Génér.*, &c.,) M. Theile, (*Angeiologie, Encyclopedie Anat.*, t. III., p. 530, et suiv.,) and M. Is. Geoffroy Saint-Hilaire, (*Hist. Gén. et Partic. des Anomalies de l'Organ.*, t. I., p. 456, et suiv.,) where will be seen that there is no branch of this artery, so to speak, whose place of origin is not subject to variations; and as most of these branches have considerable size, the point at which they are given off from the trunk of the hypogastric cannot be a matter of indifference in the application of the ligature. It is easy to perceive that if this is placed immediately below the abnormal insertion of a considerable sized branch, the obliteration of the trunk will be rendered difficult, and the patient operated upon will run the risk of a hemorrhage so much the more dangerous as the vessel is situated at a greater depth, and which cannot be arrested but by means that are exceedingly uncertain. This he thinks was the cause of the consecutive hemorrhage which proved fatal in the case of M. Atkinson.

The trunk of the hypogastric is extremely variable in its calibre, and especially in its length, and its direction also is very irregular, all which facts M. Bouisson has been enabled to verify by a great number of specimens in the museum of the faculty of Montpellier. Its length varies even from 2 to 10 centimeters. In a preparation made by M. E. Delmas, of Montpellier, M. Bouisson remarks, that on the right, the two arteries, external iliac and hypogastric, preserve their normal relations, but are changed in texture and contain osseous plates. The tendency to ossification in the hypogastric arteries had been noticed by Haller, and since by Sandifort who mentions (*Fabulæ Anatomicae*, &c., Leyden, 1804) a remarkable case of this kind, followed by aneurism. On the left side, in the specimen of M. Delmas the relations of the two arteries are reversed, their curvatures being in an opposite direction, and placed in such manner that the hypogastric is in a certain portion of its length in front and to the outside of the external iliac, an arrangement analogous to that which exists in the normal state, in the origin of the internal and external carotids, and which might have led the operator into an error by inducing him to tie the external iliac in place of the hypogastric.

M. Bouisson does not absolutely deny that there may be cases when the hypogastric artery should be tied for aneurisms in the gluteal region; but he wishes to dissuade from such operations whenever it is practicable to tie the gluteal or ischiatic, and this he thinks may be generally done with success by tying the cardinal portion or both ends of the wounded vessel if the tumor is but slightly developed, and if there is immediate hemorrhage, and the operation is performed as soon as possible after the

injury is received. If the arterial lesion is purely local we may tie the vessel beyond [au-delà, i. e., on the distal side of) the aneurism.

The cardinal operation on the retro-pelvic trunks is especially indicated, and of incontestible advantage in traumatic aneurisms of that region, particularly where the branches of these trunks are the seat of the aneurismal tumor, (i. e., false diffused or false circumscribed aneurism.)

Manual of the Operation for tying the Gluteal Artery.—*Process of M. Bouisson.*—After repeated trials on the dead body, the professor of Montpellier is satisfied that the method of Harrison, (Surgical Anatomy of the Arteries, vol. II., No. 93, Dublin, 1829, 2d ed.,) that of making the incision parallel with the fibres of the gluteus maximus muscle, though hitherto universally adopted, is defective, particularly in fat persons with thick muscles, not only because of the depth we are then obliged to go, and that their separation by this kind of incision is, in consequence of the retraction of the muscle exceedingly difficult, but also because we are more likely to wound not only the gluteal vein but the branches of the gluteal and ischiatic arteries, and the ramifications of those arteries, inasmuch as their general course is transverse to the fibres of the muscle in question. *A fortiori* the transverse incision is infinitely preferable, enabling us to save those arterial branches, and, moreover, the fibres thus divided transversely, separate wider apart, while modern surgery, especially the operations of M. Jules Guérin, have established indisputably that the thickest and widest muscles, divided through and through, readily unite by the fibro-plastic material analogous to muscular tissue, deposited in the division, and soon re-acquire all their primitive functions.

The surgeon should bear in mind the point of emergence of the gluteal artery, which is at the most elevated part of the ischiatic notch at eleven centimeters from the antero-superior spinous process of the ilium, six centimeters from the posterior superior spinous process, and ten centimeters from the most elevated part of the crest of that bone. The patient being placed on his belly, the surgeon makes a transverse incision of 6 or 7 centimeters in extent, the middle of which corresponds to the point of emergence of the vessel. This incision divides the skin, cellular tissue and gluteus maximus, and lays bare the aponeurosis in a line which is tangent to the curve of the ischiatic notch. The borders of the wound being kept asunder, the aponeurosis is divided by a grooved sound a little below the artery, whose pulsations are readily perceptible in tracing the osseous border of the ischiatic notch. The surgeon, provided with a grooved sound slightly curved and pierced at its extremity with an eye through which the ligature passes, cautiously separates with it the cellular tissue which encloses the bundle of vessels, pushes the vein or the veins, where there are several, backwards, and the nerve inwards, insinuates the beak of the sound between these organs and the artery, and raises the last under the osseous border of the ischiatic notch. The extremity of the sound must be made to go down sufficiently deep, in order to be sure of

seizing the arterial trunk; otherwise we may run the risk of including only one of its divisions, (See a case of this kind related by Malgaigne, *Anat. Chirurg.*, t. II., 1838,) and miss the trunk itself. The transverse incision, it will be found, gives an infinite deal of facility to these manipulations. The gluteal is stated by Muzel (*Medicinische und Chirurgische Wahrnehmungen*, Berlin, 1754, 64 à 72, in octavo,) to have been first tied by a surgeon in the middle of the last century, and not again until by Jno. Bell, in 1808.

Manual of the Operation for Tying the Ischiatic Artery.—*Process of M. Bouisson.*—Though often wounded and the seat of aneurisms, M. Bouisson knows of no case in which a ligature has been applied to it; though this can be done, he thinks, with even more ease than upon the gluteal. Lizars and Harrison recommend an incision similar to that for the gluteal, though the latter remarks that it should be an inch and a half lower down.

Chelius attributes also to Zang the recommendation of a small incision parallel to the fibres of the gluteus maximus, but external to the tuberosity of the ischium, by which we arrive at the external border of the tubero-sacral ligament and find the ischiatic artery on the ischio-sacral ligament.

M. Bouisson has frequently reached the ischiatic artery by means of the same transverse incision, which he recommends for the gluteal. The ischiatic artery emerges from under the pyriform (pyramidal) muscle, precisely at the middle of a line drawn from the postero-superior spinous process of the ilium to the tuberosity of the ischium. A transverse incision of six centimeters in extent should pass through the point indicated, going through the skin, cellular tissue and gluteus maximus. The artery is found on the inside of the sciatic nerve, and the vein on its posterior and inner side, when the former is carefully separated and raised up in the manner described for the gluteal.

The same incision would answer for the internal pudic, which is situated at a few millimeters from the inner side of the ischiatic.

Process of M. Diday for Ligature upon the Gluteal Artery.—The interesting researches of M. Bouisson have given occasion to M. Diday, (See his letter to M. Guérin of the *Gazette Méd.* of Paris, April 5, 1845, t. XII., p. 219,) to recal a process for tying the gluteal artery which suggested itself to him when he was a student of anatomy, and which he states to have been as follows:—The patient, being placed upon his belly, a thread is stretched from the point of the coccyx to the most elevated point on the crest of the ilium about two inches behind the antero-superior spinous process of that bone. From the middle of this thread, a point easily determined by doubling the thread upon itself, draw an imaginary perpendicular line. This perpendicular indicates the direction to be given to the incision in order that it may fall in a line with the fibres of the gluteus maximus. The gluteal artery emerges from the pelvis *exactly at the point of intersection of these two lines*. In other respects M. Diday proceeds after the manner of Harrison, but totally condemns as obscure and uncertain his geometrical diagrams of lines, points

and measurements for determining the exact locality of the artery. M. Diday's process, the originality of which lies in the anatomical rules by which we are to recognise the true position of the gluteal artery, and not in the process of the operator, is favorably mentioned by M. Pétrequin, (*Traité d'Anatom. Medico-Chirurg. et Topog.*, p. 655,) who, while himself proposing a new method, remarks, however, that by following the interlineations of M. Diday we should run the risk of falling somewhat in advance of the artery.

Inasmuch as the points and lines designated may help to a certain extent to identify with greater precision the true position of the artery, but which from the diversity in the anatomical relations of the pelvis being as infinite as the individuals of the human species itself, never can be *mathematically* arrived at, we have thought it advisable to give above the rules as laid down by M. Diday; but the *transverse* incision afterwards, according to the process of M. Bouisson, is, in our view, sustained by such unanswerable arguments, that it should always have the decided preference. T.]

ARTICLE XI.—THE PRIMITIVE ILIAC ARTERY.

§ I.—*Anatomy.*

There are two circumstances that cause a variation of length in the common iliacs: 1, in place of the fifth, it is very often on the body of the fourth lumbar vertebra that the aorta bifurcates; 2, the trunk (racine) of the secondary iliacs may be found much nearer than usual to the sacro-vertebral angle; 3, one of the primitive iliacs may be longer than the other, and that because the trunk, (i. e., the aorta,) from which they arise, is not always found on the median line. Their length, however, apart from some exceptions that are sufficiently rare, hardly ever varies more than from three or four lines to an inch. They rest (sont appuyées) upon the side of the sacro-lumbar angle, the wings of the sacrum, and against the inner side of the psoas muscles. On the right, the vein is outside and then behind; on the left, on the contrary, it lies upon the inside, and does not arrive there until after having passed under the root of the arterial trunk on the opposite side. The peritoneum alone covers them; so that in thin subjects it is still more easy to compress them than the external iliacs, provided however we have taken care to separate the mass of small intestines from them.

§ II.—*Indications.*

Bogros opened, in my presence, a subject whose primitive iliac had been wounded by a pistol-ball, thirty-six hours before death. M. Gibson relates a similar fact, and it is easy to conceive, that aneurisms may extend from the two secondary iliacs, as far as to the common iliac, and even attack the latter the first.

It required no little boldness to undertake to obliterate an arterial trunk of such size, approximated so near to the aorta, and so deeply situated. Where the external iliac is wanting the blood passes into the limb by the internal iliac; where one hypogastric is wanting the blood is furnished by the other, but what can replace the common iliac? How deprive an entire fifth of the body of sanguineous circulation, without causing its death? Many surgeons at first believed the thing impossible.

At present it is no longer a question; practice has answered in the affirmative; and if refrigerants, depletives, relaxants, and digitalis should have failed, and if the aneurism should have ascended so high as to make the ligature upon the external iliac uncertain, or insufficient, and forbid the employment of the method of Brasdor, then the ligature upon the primitive iliac should be made trial of as a last resource.

M. Gibson (*Medical Recorder*, vol. III., p. 185) performed it unsuccessfully for a wound in the case I have mentioned above, but it quickly terminated in death. But the Professor V. Mott, (*American Journal of Medical Sciences*, Nov. 1827,) who was the first to perform it according to precise rules, on the 15th of March, 1827, for an aneurism of considerable size, saved his patient; neither hemorrhage nor gangrene supervened, and the individual was enabled to resume his customary occupations. In the year following, M. Crampton, (*Med. and Phys. Journal*, January, 1831,) desirous of imitating the skilful practitioner of New York, was not so fortunate; his patient died from hemorrhage on the fourth day. The case, nevertheless, was in effect one of very great importance. The circulation, heat, and sensibility, momentarily suspended, had been completely re-established in the limb; everything promised a new triumph, when the ligature appeared to have got displaced, and an internal hemorrhage came on, which destroyed these favorable anticipations; on opening the body, the circumstances were such as to lead to the belief, that the ligature of animal substance, which M. Crampton had used, (*Arch. Gén. de Méd.* t. XXV., p. 561,) had been dissolved, or ruptured, before having obliterated the artery. The authenticity of these two operations is, moreover, sufficiently guaranteed by the name alone of the authors; one enjoys a reputation and a celebrity justly appreciated in America and by all Europe, the other is at the head of a public establishment and hospital in England. [Dublin, in Ireland. T.] In addition to all which, many other repetitions of the operation since 1831, the epoch when I wrote these lines, have made the ligature upon the primitive iliac artery a common occurrence, which is no longer looked upon as extraordinary. Though a wounded horse, on which M. Gedding (*Jour. des Conn. Méd.-Chir.*, t. III., p. 428) performed this operation, died on the sixth day, of peritonitis; a patient whom M. Leuret saw at the hospital of the Surgical Academy of St. Petersburg, and the details of which have been published by the operator, M. Salomon, (*Gaz. Méd. de Paris*, 1837, p. 598-650,) recovered perfectly. A celebrated surgeon of London, M. Guthrie, had no hesita-

tion in performing it. Unfortunately, the six lines that M. Hancock (Velpéau, *Anat. Chir.*, trad. Angl., p. 239) has devoted to the description of the case, though he says he attended to the progress of the case, do not explain, with sufficient clearness, what was the result.

§ III.—*Operative Process.*

As to the process to be followed, it is exactly the same for the common iliac as for the external iliac. M. Mott commenced his incision on the outer side of the inguinal ring, half an inch above Poupart's ligament, and carried it to above the superior spinous process of the ilium, giving it a semicircular direction, and an extent of about eight inches. That of M. Crampton, also, of a semicircular form, the concavity towards the umbilicus, and the length about seven inches, extended from the last rib to the antero-superior portion of the crest of the ilium. Both detached the peritoneum with the fingers, and nothing occurred to lead to the belief that they found any great difficulty in seizing or tying the vessel.

In these cases the circulation of the blood is re-established by the anastomoses of the internal mammary, and of the epigastric, with the lower lumbar arteries, and the anterior iliac, or even the ilio-lumbar, and also the anastomoses of the hypogastric artery and other branches upon the sound side, with those of the diseased side. [See *Remarks of Dr. Mott*, infra, on Aneurisms, and also a note under the same, on the Ligature of the *Primitive Iliac*. T.]

ARTICLE XII.—ABDOMINAL AORTA.

§ I.—*Anatomy.*

Situated in front of, and a little to the left of the bodies of the vertebræ, accompanied by the vena cava, on the right, enveloped in a fibro-cellular sheath, crossed posteriorly by the lumbar veins, anteriorly by the pancreas, duodenum, the splenic vein, or the trunk of the vena portarum, and the left renal vein, surrounded by vessels and lymphatic ganglions, and having in front of it the stomach, the transverse meso-colon, and the root of the mesentery, —the abdominal aorta, from its passage through the pillars of the diaphragm, to its bifurcation in front of the sacro-vertebral angle, furnishes a great number of branches, which it is important should be kept in view. The coeliac, the emulgent, and the great mesenteric, derive their origin from its upper half, that is to say, they are given off from it above, or in the meso-colic portion of the mesentery. A long interval, therefore, separates them from the inferior mesenteric, which is given off from it at an inch and a half, or two inches, above the common iliacs. In crossing the bodies of the vertebræ, the lumbar arteries are bound down by small and extremely strong fibrous arcades, and thus constitute so many fixed

roots, which prevent the aorta from being displaced more than a few lines, either in this or that direction, without almost inevitably causing their rupture. It is evident, from the ensemble of these relations, that by pushing the small intestines to the right, or keeping them aside, in any manner whatever, the aorta may be easily compressed against the vertebræ, between the two mesenteries, or immediately above its bifurcation; that these two points are the only ones which present an opportunity for surgical resources, and that it is there that it would be necessary to apply the thumb, through the walls of the abdomen, until something better could be done, if it became urgent to suspend a serious hemorrhage in the lower arterial system.

§ II.—*Indications.*

No artery of the splanchnic cavities is more frequently the seat of aneurism, from internal causes, than the aorta; and in no artery does either aneurism, or the slightest traumatic lesion, present so many dangers, or is more frequently followed by death. If it be that no wound, or ulceration, nor any solution of continuity in an artery, can be cured without effecting the obliteration of the vessel, which is the seat of it, how can we conceive that such a termination, admitting that it may be possible, in the aorta, would not, at the same time, be of necessity mortal? Yet such, nevertheless, would seem to be the fact, from the several cases which follow:

1. *Stenzel* (*De Steatomatib. Aorte*) gives the case of two steatomatous tumors in the substance even of the walls of the aorta, under its arch (*crosse*;) the arterial trunk was almost impermeable. Nothing had led to the suspicion of such an arrangement during life: 2 and 3. *Meckel* (*Acad. de Berlin*, t. XII., p. 62) saw two dead bodies, with the abdominal limbs well nourished, and the aorta considerably contracted under its curvature; 4. *M. A. Severin*, (*De Recondit. Abscess.*, etc., lib. IV.,) the aorta under the emulgents completely shut up by a solid concretion; 5. *Staerk*, (*Ann. Méd.*, vol. I., p. 260, ou *Barth*, *Press. Méd.*, t. I.,) a similar case to those of *Meckel*; 6. *Paris*, (*Journal de Desault*, t. II., p. 107,) the aorta under the arch, reduced to the extent of some lines, to so small a calibre, that it was difficult to introduce a crow-quill into it; 7. Complete obliteration at the same point, seen by *Graham*, (*Trans. Méd.-Chir.*, vol. V., p. 287,) 8. *Rainy*, (*Journal de Leroux*, t. XXXII., p. 377,) saw a similar fact at the hospital of Glasgow, 1814; the specimen was given to M. Monteith. 9. *Monro*, (*Journal des Progrès*, t. IV.,) the aorta obliterated, in consequence of the relics of an old aneurism immediately above the primitive iliacs; 10. *Goodisson*, (*Bulletin de la Faculté*, t. VI., p. 130, 138,) an obliteration extending to the two common iliacs; 11. *Reynaul*, (*Journal Hebdomad.*, t. I., p. 161,) an extreme contraction of the thoracic aorta. 12. *M. A. Meckel*, (*Jour. Compt. des Sc. Méd.*, t. XXX., p. 88,) the aorta so contracted under the arterial canal, that it was with difficulty a small straw could enter it. *M. A. Cooper*,

(*Œuvres, etc.*, trad. Chassaignac et Richelot, p. 542,) complete obliteration of the abdominal aorta. *M. Key*, (*Journ. des Progrès*, t. II., p. 19,) another in a paraplegic.

To these facts we may add those of *Piorry*, (*Journal Universel des Sciences Médicales*, Mars, 1816,) the aorta contracted near the arch; *Baffos*, (*Archiv. Gén. de Méd.*, t. XIV., p. 611,) the iliac aorta obliterated; *Nicod*, (*Archiv. Gén. de Méd.*, t. VII., p. 466,) the same by concretion; *Pailloux*, (*Biblioth. Méd.*, 1829, t. I., p. 337,) the aorta below obliterated by concretion; *Berton*, (*Rev. Méd.*, 1829, t. II., p. 244,) thoracic aorta, aneurism, and concretion; *Schlesinger*, (*Encyclop. des Sc. Méd.*, 1836, p. 85,) abdominal aorta obliterated; *Légrand* the same; (*Rétrécissem. de l'Aorta, &c.*, 1834;) also those of *Spangenberg*, *Hervey*, *Laennec*, *Bright*, and *H. Bernard*, (*Dict. de Méd.*, 2e edit., t. III., p. 400,) and those of *Nixton*, *Andral*, *Larcheus*, *Fontanus*, *Dell Arme*, *Morgagni*, *Jordan*, *Maisonnette*, collected by *M. Barth*, (*Presse Méd.*, t. I., ou Thèse No. 189, Paris, 1837. An excellent work of reference.)

In almost all these subjects, the state of the aorta was evidently the result of disease; in all, the circulation had continued to go on above the strangulation; those mentioned by *M. Rainy* and *M. Key* were the only ones that complained of an habitual weakness in the legs, or palsy. On the other hand, *M. A. Cooper* and *Béclard* have, it is asserted, often tied the ventral aorta in dogs, without causing gangrene in the hinder parts (*train de derrière*) of these animals. In 1823, I dissected a cat, upon which *M. Pinel-Grandchamp* had performed this operation four months before, and in which the abdominal aorta was transformed into a fibro-cellular filament, from the superior mesenteric to the origin of the primitive iliacs. *M. Scoutetten*, (*Archiv. Gén. de Méd.*, t. XIII., p. 505,) who has effected the obliteration, in succession, of the two femorals, the two carotids, and the two subclavians, in the same animal, without causing death, also tied the aorta in one of the dogs he had thus treated. Though an acute peritonitis had supervened in this animal, the day after the operation, he had begun to walk, and to recover his appetite, when laceration of the aorta above the ligature suddenly caused his death, on the seventh day.

If this assemblage of facts would not authorize us to conclude that we might tie the abdominal aorta in man, without danger, they prove at least, and unanswerably, as it appears to me, that in spite of this ligature, the blood would ultimately create for itself a channel to reach the lower limbs. The intercostals, and the superior lumbar arteries, the internal and external mammaries, and the transverse and posterior cervicals, are large enough, in fact, to carry the fluids below the strangulated point. If the ligature was placed between the two mesenterics, in place of being applied below, we should have, in addition, the great arcades formed by the union of the right and left colic, to re-establish the circulation. The human body being, in reality, nothing more than a vast network, (*un vaste réseau*), a great vascular circle, no one, at the present time, and much less now than ever before, can entertain any

apprehension that we should arrest the course of the fluids that circulate through it, by obliterating any one portion of it.

Would then the ligature of the aorta be useful and practicable? That it is practicable we can have no doubt, since MM. A. Cooper, James, and Murray, have performed it; the first at London on the 25th of June 1817; the second at Dublin in 1829; the third at the Cape of Good Hope in 1834. As to its utility it is not near so well demonstrated. The patient of M. Cooper, (*Œuvres*, trad. Franç., p. 548,) died at the end of forty hours; that of M. James, (*The Lancet*, 1829, Vol. II., p. 607,) survived only three hours; and I find that the patient of M. Murray, (*N. Amer. Archiv. of Med. and Surgical Sciences*, 1835, p. 297,) died at the expiration of twenty-three hours. Aneurisms in one or both the common iliacs, or those which might develop themselves below the inferior mesenteric, could alone claim this operation; but the observations of MM. Monro and Goodisson, and the cases of spontaneous cure of aneurisms of the aortic arch, as related by MM. W. Darrach, Berton and Calmeil, (*Journal des Progrès*, 1e série,) show what the system can do under such circumstances. But do not internal treatment, cold applications, and moxas, combined with the methods of Valsalva, Guérin, and M. Larrey, in fact, offer in such cases, more chances of success than any operation that could be imagined? Would not the ligature first applied to the external iliac upon one side, and then upon that of the other, according to the method of Brasdor, be preferable to that upon the aorta? However, as it is possible that the essay of the English Surgeon may be repeated, I think it proper to point out the operative process.

§ III.—*The Operative Process.*

I do not deem the suggestion of penetrating into the left loin to reach the aorta, without opening into the peritoneum, as some modern writers have recommended, of any value or worthy of being discussed. The only process that prudence would allow us to undertake, is the following:—

The patient being laid upon his back, ought to have the head, thighs, and legs, moderately flexed, in order to put the walls of the belly into a state of complete relaxation. An incision of from three to four inches long, is then made upon the linea alba, a little to the left, to avoid the umbilicus, above which it would as I think, be advisable to prolong a little farther than below. Having reached the peritoneum we puncture it, in order to divide it more freely with the blunt pointed bistoury guided upon the finger; by this opening the forefinger pushes aside the intestines, penetrates to the spine, recognises the pulsations of the artery, detaches the left layer of the mesentery and the subjacent cellular sheath with the nail, and gently separates the aorta from the vena cava and the vertebræ, so as to isolate it in a proper manner. If the subject should be thin, and the walls of the abdomen be brought very near to the vertebral column; if the eye in fine, could follow the instru-

ment up to that point, a sound would advantageously replace the finger. The ligature is applied by means of the needle of Deschamps, or the ordinary ligature-holder, (*porte-fil*;) it is tightened by a double knot, while one of its ends is cut near the artery; and the other is brought through the wound which it is advisable to unite by some stitches of suture. If the ligatures of animal substance offered the same security as the others, this would be a case for giving them the preference and leaving the knot at the bottom of the wound; but experience not having yet decided upon these, I dare not recommend their employment here. M. Cooper, placed his ligature at three quarters of an inch above the primitive iliacs. It would probably be better to place it above the lower mesenteric artery; the reason for this I have given above. M. James before tying the aorta at the Exeter Hospital, July 5th, 1829, had endeavoured to obliterate the external iliac by the method of Brasdor, on the preceding 2d of June, without obtaining therefrom any marked advantages. At the opening of the dead body the external iliac artery was found divided into two trunks, which would have sufficiently explained how the first operation, which was followed by a diminution in the pulsations of the tumor had not prevented them from soon after re-acquiring their former force. The process also of M. James is nearly the same as that of M. A. Cooper's. M. Murray, (*Gaz. Méd. de Paris*, 1834, p. 502,) says, he made his incision to the left, in the direction of the aorta, and after the method of Guthrie, because he could not operate to the right, owing to the size of the tumor which ascended very high in the belly.

[Two cases of this rare form of aneurism, are related by J. Arthur Wilson, of St. George's Hospital, London: one in a female aged 24, who had been four months laboring under icterus, and severely salivated, and who after a few weeks more of severe suffering from pains between the shoulders and in the epigastric and right hypochondriac region, died in a state of great exhaustion. She had her menses twice, however, in the last seven weeks of her life, and it was remarked that the catamenial blood had a large proportion of bile. The autopsy disclosed an apparently vast liver, filling up the whole space on the right, and of a globate shape. It was smooth on its surface and firm in texture, and was found to occupy the place of an envelope to an aneurism situated at an inch from the origin of the trunk of the superior mesenteric artery. The ductus choledocus was compressed and almost effaced throughout its whole extent by the contact of this tumor. The liver was sound though livid. The biliary ducts were greatly enlarged; the gall bladder contained bile and some calcareous concretions. The Editors of the *Journal des Connaissances Medico-Chirurgicales*, (Paris, April 1, 1842, p. 169,) speaking of these cases, think this might have been *diagnosed*, or at least suspected, if the ear had been applied on the region of the liver. The touch however, we should suppose must have clearly indicated the great displacement of the organ.

In the second case, which was antecedent to the above, the tumor

made a prominence externally of the size of a small orange, disappearing in certain positions. The patient was sensible of *pulsations in the epigastrium*, various symptoms of *suffocation*, and often discharged blood from the mouth. There was no jaundice. The autopsy showed an aneurism at the commencement of the trunk of the superior mesenteric communicating freely with the aorta. The lungs contained traces of vomicæ and were also tuberculous. T.]

CHAPTER II.

ARTERIES OF THE THORACIC LIMB.

ARTICLE I.—ARTERIES OF THE HAND.

§ I.—*Anatomy.*

The *Radial Palmar Arch*, extending in the form of a segment of a circle with its convexity forward, from the dorsal origin of the first inter-osseous space, to the hypothenar eminence, where the ulnar artery completes it; being embedded in the muscles, with the bones of the metacarpus behind, and the flexors of the fingers and the other soft parts in the palm of the hand in front, is too deeply situated as respects aneurisms, to require any particular consideration. The *ulnar* or *superficial arch*, represents with sufficient exactness the shape of an arc, with its convexity downwards, of about fifteen lines in depth, and the extremities of which would fall upon the projections of the pisiform bone, and the os trapezium. Covered near its root by some fibres of the muscles of the little finger, by the palmar aponeurosis in its middle part, and over that by the sub-cutaneous tissue in its whole extent, it furnishes from its convex portion the collateral arteries of almost all the fingers. The branches of the median nerve, the tendons of the sublimis, the profundus, and lumbricales muscles, and a very loose synovial membrane separate it moreover from the deep arch, with which it is made to communicate, by means of the anterior branch of the radial artery, a collateral of the thumb and the deep branch of the ulnar.

§ II.—*Indications.*

We often meet with wounds in the hand which may become alarming from the hemorrhage which results from them. In a case mentioned by Timeus, (Bonet, *Corps de Méd.*, part II., p. 188, Obs. 37,) the loss of blood by frequent repetitions ultimately caused the death of the patient. Camper (*Demonstr. Anat. Pathol.*, etc., 1760) says the arm had to be amputated to arrest the hemorrhage in a case of wound in the deep palmar arch. The hand is also sometimes the seat of circumscribed aneurisms. Guattani met with

one in front of the thenar eminence, which was equal to the size of an orange. Becket, Fabricius of Hilden, and the *Gazette Médicale*, (1837, p. 524,) each furnish another example of this kind. In the case mentioned by Tulpius, (Bonet, *Oper. Cit.*, t. IV., p. 40, Obs. 59,) it was situated between the thumb and index finger; and at the hypothenar eminence in that of Soummé. M. Champion writes me that he has seen one in the palm of the hand. An analogous case was seen by M. Carrère (*Gaz. Méd. de Paris*, 1834, p. 255.)

The treatment of such lesions is not free from embarrassment; sometimes almost any thing will succeed, while at other times almost every thing fails. The patient of M. Champion had received a cut from a knife; the compression was badly made; the hemorrhage returned; the compression was applied better; the aneurism was formed; the patient did nothing farther. Like M. Carrère, I have seen the best applied compression fail in a stout lad who had wounded the superficial palmar arch; also in another in which the deep palmar arch had been wounded in opening an abscess. As with the cases of M. Quoy (*Jour. des Conn. Méd.-Chir.*, t. III., p. 269) and M. Pigeaux, (*Arch. Gén. de Méd.*, 2e série, t. X., p. 237,) I found in 1838, in a young man who had thrust a knife into the palm of his hand, that compression answered perfectly well. The hemorrhage of which M. Dubreuil (*Gaz. Méd. de Paris*, 1834, p. 726) speaks, coming from the palmar arch at the bottom of an abscess, at first resisted compression. The brachial artery was tied, but the blood reappeared. A second compression was successful. Compression made in two other cases with an instrument of which the sugar-tongs would convey a correct idea, succeeded very well. (*Jour. des Conn. Méd.-Chir.*, t. III., p. 10.) M. Grisolles (*Ibid.*) also cites two cases, where the compression no longer direct, but made upon the radial or ulnar arteries, was attended with complete success. The red hot iron applied by Dupuytren cured the child that M. Carrère had treated by compression.

In other respects the course to be observed is this: Is the case one of hemorrhage and recent diffused aneurism? I have then twice succeeded by tying the two ends of the artery at the bottom of the wound. To divide the palmar aponeurosis and the arterial arch itself as Camper recommends, (*Oper. Cit.*) would be a means to be tried. If the first trials of compression made upon the palm of the hand with tampons, agarie, and compresses and a bandage, or with the forceps of M. Gallias, (*Jour. des Conn. Méd.-Chir.*, t. III., p. 10,) should not succeed, it should be made in a third manner. If the direct compression is powerless or too uncomfortable to be borne, we must then have recourse to indirect compression upon the radial and ulnar above the wrist, as M. A. Bérard has done (*Gaz. Méd. de Paris*, 1833, p. 706.) Finally, if in spite of these means skilfully employed, the hemorrhage should return, or inflammation and swelling should threaten to attack the hand, there would be no longer room to hesitate; the ligature must be applied by the method of Anel. The ligature upon the radial only, aided by com-

pression upon the ulnar, was sufficient in the case cited by M. Berard or M. Pigeaux, and in a patient of Dugès, (*Jour. des Conn. Méd.-Chir.*, t. I., p. 210.) Sometimes we succeed by tying only the upper end of the wounded vessel; but as the two arteries of the fore-arm communicate freely with each other in the hand, it is more secure and generally better to surround each of them with a ligature, though only one of them has been opened. In a pork dealer whose superficial palmar arch had been divided, the bleeding came on copiously five times in succession in spite of compression both direct and indirect. I tied the ulnar and radial without waiting any longer, and though a phlegmonous tumefaction had already seized the hand and fore-arm the cure was effected. A young butcher who had had the root of the deep palmar arch and the collaterals of the index finger opened, was exhausted in consequence of repeated hemorrhages, when MM. Layraud and Vigneux sent for me. Compression, astringents and cauterization had been made trial of. I immediately tied the two arteries of the fore-arm, and all the difficulties were arrested.

In the cases of circumscribed aneurism the operation above is the one we have to depend upon; there would in fact be no choice; the method of Anel only is applicable to these cases. By the ancient method, or the opening of the sac, we should have to encounter too many difficulties in laying bare and especially in seizing the artery. The hazard incurred by M. Roux in a patient in whom he employed this method, and by M. Manoury in another, and the dangers of every kind to which we are exposed in making incisions into the palm of the hand, sufficiently show that in such cases the ligature to the radial or ulnar above the wrist would be preferable; it did not however prevent the boy upon whom M. Roux (*Gaz. Méd. de Paris*, 1837, p. 524) had made use of it for an aneurism at the thenar eminence, in 1836, at the Hotel Dieu, from dying in consequence of repeated hemorrhages.

§ III.—Operative Process.

A. We could nevertheless reach without difficulty the *superficial palmar arch* near its root, by commencing upon its radial or pisiform side, an incision, which should be prolonged forwards to the extent of about an inch and in the direction of the last metacarpal space. We should have to divide in succession the skin and its cellulose-filamentous lining, a sufficiently thin aponeurosis and some fleshy fibres.

B. It would also be very easy to tie the origin of the *deep arch upon the back of the hand*: the termination of the radial is found there at the bottom of the groove which separates the posterior extremity of the two first metacarpal bones; a fibrous lamella separates it from the tendons of the thumb, the cephalic vein and the skin. The thumb and fore finger should be extended and kept wide apart from each other, in order that the surgeon may not be incommoded by the dorsal tendons of these two fingers. An ob-

lique incision of an inch or an inch and a half long is then made at three lines from the ulnar side of the artery and in the direction of the long extensor of the thumb. Under the skin are seen large veins of the metacarpus and one of the branches of the radial nerve. If they were still in the way after pushing them aside they must be divided; the artery is still concealed by the aponeurosis, which must not be divided except upon the director. Finally in isolating the vessel by the point of the sound, it is important not to lose sight of the neighborhood of the carpo-metacarpal articulations.

ARTICLE II.—ARTERIES OF THE FORE-ARM.

§ I.—*Anatomy.*

In the fore-arm, the posterior inter-osseous artery, distributed between the two corresponding muscular layers, and the anterior inter-osseous, accompanied by its nerve, and lying upon the ligament of the same name, are of too little size, and too deeply situated to require the direct application of the ligature. It is, therefore, the radial and ulnar alone which the surgeon must look to under these circumstances.

A. In its lower third, the *radial artery*, situated in the groove which separates the tendons of the flexor carpi radialis, and of the supinator radii longus, is covered only by a single aponeurotic layer, the sub-cutaneous tissue and the skin; one or two veins run by the side of it; the nerve is at some lines outside of it, and it lies almost naked on the anterior face of the radius. Elsewhere, its relations are a little more complicated. Resting against the pronator radii teres, or the radial portion of the flexor digitorum sublimis, where it is fastened by a fibrous lamella, this artery, concealed also by the inner border of the supinator radii longus, is, nevertheless, separated from the integuments in the same manner as below, by the anti-brachial aponeurosis, and by the superficial layer, in its whole extent. Its course is indicated by a line drawn from the middle part of the elbow to the base of the styloid process, or by the outer groove (gouttière) of the fore-arm. It sometimes runs immediately under the skin; more frequently it turns back upon the outer surface of the radius at the middle of its length; while in other cases its principal branch lies in front, and goes to form almost entirely the superficial palmar arch.

B. The *ulnar*, (cubital,) concealed above by the entire thickness of the superficial muscular tissue, is on that account only submitted to surgical operations in its three lower fourths, where it is found upon the flexor digitorum profundus, between the flexor digitorum sublimis and the flexor carpi ulnaris; the vein is outside, and the nerve on the inner, that is, the ulnar side; at first, an aponeurosis, then the flexor carpi ulnaris muscle, (muscle cubital,) or its tendon, then another fibrous layer, and afterwards the adipose tis-

sue, separate it from the cutaneous envelope; we may trace its course by means of a line drawn from the inner condyle of the humerus to the radial side of the pisiform bone, for its two lower thirds, and by a line drawn from the middle of the bend of the arm to the union of the middle third with the upper third of the ulna, for the upper third of its course. Its *anomalies* of position are much more frequent than those of the radial; I have often found it between the aponeurosis and the skin, either in its whole or a part of its length; I know many persons with this peculiarity. At other times we find it between the aponeurosis and the muscles; in certain cases it runs for a long distance near the axis of the limb, and does not approximate to the ulnar nerve until when it is near the wrist.

§ II.—*Indications.*

There is no doubt but that an aneurism of the radial near the wrist might yield to compression, nor is there any that we ought to attempt this means in irritable, timid subjects, like the one for example that A. Petit speaks of, and who died of spasms from a ligature upon the radial; it is equally certain also, as M. Pigeaux (*Arch. Gén. de Méd.*, 2e sér., t. X., p. 337) says, that most of the hemorrhages of the fore-arm could be arrested by compression properly made.

A. *Compression*.—The patient of Tulpus above referred to was cured of his aneurism by this mode. A wound of the radial near the carpus, was also cured by means of a kind of tourniquet invented by Scultetus, (*Arsenal de Chir.*, p. 335, obs. 89, pl. 19, fig. 4.) In another case Formi (*Bonet, Oper. Cit.*, t. I., p. 190) succeeded equally well by plugging with tents, (tamponnement,) and compression. The patient treated by Favire, also had a wound of the radial. The arteries of the fore-arm are wounded; the radial is tied; the hemorrhage reappears; which is the artery wounded? they could not tell, says Dudaumon, (*Thèse, Paris, 1803*;) in this doubt they attempt indirect compression with an apparatus expressly made for it; the patient got well. Compression proved insufficient, and it was necessary to come to the ligature in the cases of Herin, (*Pathol. Chirurg.*, t. II., p. 48,) Mestivier, Martin, (*Anc. Journ. de Méd.*, t. XXX., p. 270—274,) Pelletan, (*Clin. Chir.*, t. II., p. 270,) and Ouvrart, (*Obs. de Méd. et de Chir.*, p. 253—255.) Bourienne, (*Journal de Horn*, t. VII., p. 277,) who rejects the ligature as useless, and also strong compression, employed with success in the case of a wound of the inter-osseous artery, cauterization, aided by slight compression. But M. Gouraud (*Essai sur la Formation des Os*, Thèse de Paris) speaks of a similar lesion which could not be cured by compression, and which obliged him to tie the trunk of the brachial. A patient of whom Detharding (Planque, *Bibl.*, t. XXVII., p. 40) speaks, was more fortunate. The artery of the wrist is opened. The patient cannot support the tourniquet. They were about to amputate, when one of the surgeons introduced a plug (bouton) of blue vitriol into the vessel, and stopped the blood.

Plugging with tents, and compression, succeeded very well in a case of wound of the ulnar, related by Leprince, (*Journ. de Horn*, t. I., p. 398.) M. Quoy (*Journ. des Conn. Méd.-Chir.*, t. I., p. 26,) effectually arrested, by means of direct compression, a hemorrhage of the arteries of the wrist, by deciding to make the compression on the two arteries separately. M. B. Cooper (*Presse Méd.*, t. I., p. 455) was not less fortunate for a wound of the ulnar. I have already remarked that the hemorrhage did not return in one of my patients who had the ulnar artery divided, though compression was not made upon the brachial longer than twenty-four hours.

B. All this does not prevent the *ligature* from being the most certain remedy, and the one that may be employed with least danger in lesions of arteries of the fore-arm. Compression and the ligature, moreover, are two resources which we must often in these cases call to the aid of each other. Instead, for example, of tying those two arteries at the same time for a wound in the hand, as the extensive anastomoses of the palmar arches would seem to require, we may content ourselves with placing a ligature on the principal, and with compressing the other. At and above the wrist, if the upper end of the artery which has been opened has been tied, it will then be found sufficient, in order to prevent the return of blood or the hemorrhage, to make compression upon its lower end.

Since I laid down these rules, M. A. Berard, (*Gaz. de Paris*, 1833, p. 706,) has confirmed them by two facts. A case published by M. Quoy, (*Journ. des Conn. Méd.-Chir.*, t. I., p. 269,) sustains them in the same manner. I may say as much of that of Dugès, (*Ibid.*, p. 210,) and of some others. With M. H. Berard, (*Arch. Gén. de Méd.*, 2e série, t. VII., p. 448,) and M. Sédillot, (*Gaz. Méd. de Paris*, 1834, p. 41,) the method of Anel was found sufficient to arrest a hemorrhage on the fourteenth day from a wound either of the ulnar or the brachial artery. It would be the same for circumscribed aneurisms; Soimné, (*Gaz. Méd. de Paris*, 1833, p. 695,) also cured his patient by tying the ulnar in the middle of the fore-arm. It is nevertheless true, that in a patient who had had the radial artery wounded, M. Dubreuil, (*Ibid.*, 1834, p. 726,) after having tried compression and the ligature upon the radial and then upon the ulnar, was obliged to come to the ligature of the brachial artery itself.

If the wound whether traumatic or spontaneous, were situated in the dorsal branch of the ulnar artery, of which MM. Pillet, (*Thèse* No. 176, Paris, 1827,) and Baretta, saw an instance at the Hospital of Lyon, or in any other branch in the same region, the ligature which is attended with but little danger, and easy of application, and which should be placed above and under the disease, by the ancient method, should be preferred to any other mode.

§ III.—Operative Process.

Unless the ligature is to be made in the wound itself, it is to be

applied immediately above the wrist, or to the upper third of the fore-arm.

A. *The Radial above the wrist.*—When we wish to tie the radial artery above the wrist, the hand should be placed in supination. The surgeon seated outside, makes with a straight or convex bistoury an incision into the integument of from one to two inches, in the direction of the artery, between the flexor carpi radialis and the supinator longus, taking care not to go too deeply at first. Afterwards he divides the aponeurosis which has been previously raised up, in such manner that the bistoury passed along the groove of the sound cannot touch the vessels. As the nerve is situated at a great distance from it, and the collateral vein is of but little importance, it is a matter of indifference whether the artery is seized by its inner or outward side; only that we ought to avoid denuding it to too great an extent.

B. *The Ulnar above the wrist.*—The hand and the fore-arm are placed for the ulnar as in the preceding case. We give the incision the same extent and the same direction. Nor should it either descend to a line with the radio-carpal articulation; also it is upon the radial border of the flexor carpi ulnaris, or in the inner groove of the fore-arm, that this incision is to be made. After having divided the skin, the adipose tissue and the thin fibrous layer which covers the tendon of the flexor carpi ulnaris, and pushed this tendon inwardly, we perceive the artery through a second aponeurotic layer, situated on the radial side of, and a little anterior to, the ulnar nerve.

C. *The Radial at the upper third of the fore-arm.*—As we are obliged to penetrate deeper in the upper third of the fore-arm than below, it is advisable to give at least two inches of extent to the wound, which should be a little oblique from within outward, in order not to go too far from the line of the track of the artery. If then the superficial radial vein or the common median should present themselves under the skin, they must be pushed aside with the sound. It is better to fall some lines without than within the border of the supinator longus muscle; at this outer side the aponeurosis has not yet divided, (*dedoublée*) and we find only a single layer of it. In the other, that is to say, on the border of the muscle itself, a first layer has to be first divided, and then the fleshy bundle is drawn to the distance of some lines outwardly; a second layer is seen beneath, this is divided upon the sound, and then the artery may easily be seized hold of.

D. *The Ulnar on the middle third of the fore-arm.*—The ligature upon the ulnar on its upper third, or its middle portion, is deemed one of the most difficult in the thoracic extremity, which is owing probably to the fact that most authors have given but very vague rules for performing it. Nevertheless, I have not found that it required either on the dead subject, or on the living body, much more address than the radial, if we adopt the following mode:—

Process of the Author.—We make an incision of from three to four inches, which commences at three fingers width from the ulnar

articulation (trochlée) of the humerus, and descends to the middle of the fore-arm, in the direction of the line mentioned above. When the aponeurosis is laid bare, we seek for the interstice of the flexor carpi ulnaris and the flexor of the little finger. In order not to be deceived, it is sufficient to draw the internal border of the wound towards the ulnar side of the limb; directing our attention then to the median line, the first rather opaque (*un peu épaisse*) and yellowish or grayish appearance (*trace*) that we meet is a certain mark of the interstice sought for. We then incise the aponeurosis on the outer border of this line to the same extent as the skin. That being done, we separate the flexor carpi ulnaris and flexor of the little finger from each other with the fore-finger, the handle of the scalpel, or the sound. We soon perceive, at the bottom of the wound, a large yellow or whitish cord, which is the ulnar nerve, having the artery on its radial side. To seize this latter, it is not even necessary that we should see it, as we are certain to raise it up by directing the extremity of the sound between it and the nerve.

II. *Process of M. Guthrie*.—If the disease was situated higher up upon the ulnar artery, inasmuch as it changes its direction and becomes more and more difficult to cut down to, it would be evidently preferable to tie the brachial itself. M. Guthrie, who has done this once successfully, recommends that we should always proceed to search for the ulnar itself in the part wounded, though it should be necessary to cut through the muscles transversely; but this advice ought not to be followed, unless there already existed a wound of considerable size, with contusion of the parts.

ARTICLE III.—ARTERIES OF THE ELBOW.

§ I.—*Anatomy*.

At the bend of the arm the humeral artery terminates, by giving origin to the radial and ulnar branches; but in place of this occurring opposite to, or below the coronoid process, its bifurcation sometimes takes place in front of the articulation, or even much higher. In descending, it follows an oblique direction from within outwards, is situated upon the inner bundle of the brachialis internus muscle, between the biceps flexor cubiti, and pronator radii teres, and quite below, inclines to cross in the same direction the anterior surface of the tendon of the biceps. The deep-seated vein, (*veine profonde*,) runs upon its radial side, and the median nerve, which sometimes touches its ulnar border, is not unfrequently separated from it by a fasciculus of the brachialis internus muscle. A cellular sheath, of greater or less density, encloses it, as well as the vein. Crossed, and as if bridled down by the fibrous *bandelette* of the biceps, afterwards covered by the aponeurosis of that region, it has in front of it, at first the trunk of the basilic vein, then the corresponding median vein, the branches of the internal cutaneous nerve, and the cellulo-adipose tissue, which organs separate it to

a greater or less distance from the skin. When the bifurcation takes place higher up than usual, the nerve lies, in general, between the two arterial trunks, and it is then that the ulnar is specially inclined to creep under the skin.

§ II.—*Indications.*

The bend of the arm is the part of the body where aneurism is most frequently met with, especially false, or traumatic aneurism, whether diffused, circumscribed, or varicose. Spontaneous aneurism may be caused there, as in front of all the articulations, by a violent extension of the fore-arm, as happened, for example, in the innkeeper mentioned by Saviard, (*Observ. Chirurg.*, &c., p. 22, 27.) It is much more rare here, however, than in the ham, or even at the fold of the groin. Apart from those which have been related by Fordyce, Flajani, Paletta, Lassus, Pelletan, and M. Roux, there are scarcely any instances of these aneurisms to be found in the most approved authors, and Scarpa himself does not appear to have met with them. As to varicose aneurism this is pre-eminently its seat, whether it exists in its natural state, or is complicated with a false circumscribed aneurism. I have also seen a varicose dilatation of all the arteries of the hand and fore-arm, extending up as high as the tendon of the biceps. It was at the fold of the arm that an aneurismal sac was seen by Physick, (Dorsey, *Elemen. de Chirurg.*, t. II., p. 268, pl. 24,) of the size of an egg, between the vein and artery, with both of which it communicated.

It is not only for aneurisms at the bend of the arm, but also for those which occupy the upper third of the fore-arm, that we apply the ligature upon the brachial artery, in this region. At the present day it is even much more frequently for these last that we have recourse to it, than for the first, since, in such cases, the method of Anel obliges us to carry the ligature to a point situated at a greater or less distance above the elbow.

A. The cure *spontaneously*, or with the aid of *compression*, of aneurisms at the bend of the arm, has been so often observed, that it has now become quite a common thing. D. Pomarest (*Biblioth. de Bonet*, t. IV., p. 104) relates the case of a patient who never would submit to an operation, and in whom the aneurism ultimately burst, and thus got completely well. A hemlock plaster, aided by astringents, purgatives, and compression, succeeded with Fabricius, of Hilden, (*Ibid.*, p. 96,) for an aneurism of the size of an egg. We find in Plater (*Bonet, Corps de Méd.*, t. III., p. 24) the case of an aneurism of this kind, in which nothing was done. Demarque (*Oper. Citat.*, p. 504) cured four of these aneurisms by bandages, aided by topical astringents. Monteggia speaks of a man seventy-six years of age, who had the artery opened during a bleeding, and whom it was proposed to cure by a bandage. The patient could not support this treatment. Different accidents, which at first seemed quite alarming, ultimately disappeared, and with them the aneurismal tumor. Galen cured an aneurism at the elbow, in a

young man, by regular compression. Genga appears to have succeeded often by the aid of a bandage, generally attributed to Theden. White, Desault, Foubert, and Scarpa, have given examples in favor of this method, which the Abbé Bourdelot gave popularity to, more than a century since, by having applied it successfully upon himself. I have, myself, employed it with success in two cases of recent varicose aneurisms. It has succeeded three times with Mothe, (*Mél. de Méd. et de Chir.*, p. 61 et 66,) who, on the other hand states, that in another case, it produced gangrene. Compression appears likewise to have succeeded in two rather imperfectly described cases, by M. Heustis, (*Jour. des Conn. Méd.*, t. III., p. 72.) A young woman who had had the fold of the arm wounded by the cut of a knife, came into my department at La Pitié; on applying compression to the hemorrhage she was apparently cured. At the end of fifteen days the blood reappeared, and obliged me to tie the brachial artery.

B. On the other hand, the disease may be slow in its progress, and scarcely incommode the patient who is the subject of it. "There occurred," says Saviard, (*Nouv. Recueil d'Observ.*, p. 272, Obs. 61,) "an aneurism of the size of a walnut, at the bend of the elbow, in a man, after bleeding; he carried it with him during sixteen years, and without ceasing to labor in the coal mines." Patients have thus lived along for thirty years, (Senert,) and even fifty, (Preuss. Helwich.) M. Ribes, (*Gaz. Méd. de Paris*, 1835, p. 161,) who has collected these cases, cites one which continued for twenty-eight years. Nevertheless, as this aneurism, sooner or later, with a few rare exceptions, ultimately compromises the life of the patient, the surgeon is not to be influenced by any of those considerations. In ordinary cases, if compression should not appear to the surgeon to answer the object, or if he has tried it without advantage, he would be censurable not to have recourse promptly to the ligature.

C. *Operation*.—It was for aneurisms at the elbow only that the methods of Aetius and Guillemeau were employed, until Keisler, and the surgeons of Italy, had ventured to treat in the same manner the aneurisms of the popliteal space. It was in that region also that Anel cured one of these tumors without touching it, confining himself to tying the artery above it; a process which Mirault, (*Bulletin de la Faculté*, t. III., p. 312,) of Angers, was the first among us to imitate, in 1787.

I. Though it be generally conceded, that the *method of Anel* suffices here, the operation is sometimes performed by the method of Keisler, in diffused aneurism, for example, also in varicose and in circumscribed aneurism where the walls are very much attenuated or disorganized. The reason given for it in the first place is, that by confining ourselves to tying the upper end, we incur the risk of having the hemorrhage return by the lower end; that in the second place, by obliterating the artery above, the blood will nevertheless continue to pass into the vein by the communicating aperture; in the third, that in this state it is impossible to obtain re-

solution of the aneurismal sac ; and that it is necessary to open it and empty it of its clots, to prevent gangrene ; and that in every case we preserve a greater number of anastomosing branches.

II. These motives, in reality, do not demonstrate the absolute necessity of the *ancient method* in such cases. If the tumor does not shrink upon itself after the operation, or threatens to suppurate, nothing prevents our treating it as a purulent collection. To put a stop to the hemorrhage, supposing that it continues after the ligature above a recent traumatic aneurism, compression, even though moderate, rarely fails to succeed. Though it be true, that in a patient operated upon by the new method, at the Hotel Dieu, the progress of the aneurism did not yield to the opening of the sac and the ligature upon the two ends of the vessel, it is not clear from the details of the operation, that the humeral artery was actually included in the ligature at the time of the first operation. Nevertheless, M. Guthrie, though a warm partisan of the method of Keisler, relates a fact on this point which affords room for reflection. A man had the artery punctured by a lancet. It is tied above. The hemorrhage reappears, and it is tied higher up. The hemorrhage takes place again. Amputation is performed and the patient dies. It was necessary, says the author, to have tied not only the brachial, but also the origin of the radial and of the ulnar.

III. As to *varicose aneurism*, (anéurisme variqueux,) it must be admitted that a certain number of facts seem to justify the recommendation of treating it by the ancient method. In the operative surgery of Sabatier, we find four cases of Dupuytren in support of this opinion. In the first, in spite of the ligature by the mode of Anel, it became necessary to have recourse to amputation of the limb ; in the second there came on a stiffness and false ankylosis of the fingers, with other accidents, which also rendered amputation necessary ; in fine, in the third and fourth, the patients were ultimately restored by a second operation, which allowed of tying the artery above and below the wound. In a patient, whose case is related by M. Alquié, (*Gaz. Méd. de Paris*, 1837, p. 347,) it was tied above : upon hemorrhage recurring, a second ligature was placed above : the hemorrhage returned, and compression was used ; another hemorrhage recurred ; rest in bed, and compression, effected the cure.

Nevertheless, a case has since been reported, where a ligature upon the brachial alone sufficed (*Archiv. Gén. de Méd.*, 2e série, t. VI., p. 576) to cure a varicose aneurism at the bend of the arm. But there is a previous question to be solved here. Is varicose aneurism, in itself, of a nature sufficiently serious to justify such operations ? What I have said above, and a recent case of M. Pl. Portal, (*Clin. Chir.*, t. I., p. 203,) and that of M. Brown, (*Arch. Gén. de Méd.*, 2e série, t. X., p. 370,) may authorize us to doubt if it is. I would not, therefore, decide upon this course, unless the functions of the limb were disturbed to so great a degree as to expose the patient to imminent peril.

§ III.—*Operative Process.*

When we have once decided upon tying the brachial artery at the elbow, whatever be the motive that influences us, the following is the manner in which it is to be performed :—

I. The fore-arm being extended, and separated to a greater or less distance from the body, is turned back upon its dorsal surface, and kept in a state of supination. An incision is made three inches long, parallel to the radial, or upper border of the pronator radii teres muscle, commencing at near an inch above the internal condyle, and terminating in the middle of the bend of the arm. Under the skin are found the superficial veins, particularly the median-vasilic vein, and the branches of the cutaneous nerve which accompany it. An assistant is charged with holding them aside with a blunt hook, or the end of a curved sound. When some of their branches incommode too much, or cannot be conveniently kept out of the way, we should divide them between two ligatures, or even without this precaution, when they are of small size ; we then come to the aponeurosis, which we must divide upon a grooved sound. Even though we might preserve the bandelette of the biceps, it is better to sacrifice it ; we are then much more at our ease for the rest of the operation. After having freed the artery of the lamellar and adipose tissue which surrounds it ; and after having isolated it from the vein, or the deep veins, as well as from the median nerve, we pass between it and this last cord, the extremity of a sound, which is then carried behind it to raise it up, while with a nail of the other hand we prevent the veins from accompanying it, or from getting on the point of the instrument, after which there remains nothing more to conclude the operation, than to apply the ligature and dress the wound.

II. The course of the blood, though temporarily interrupted, is soon established by two anastomosing circles, which the internal and external collateral arteries of the brachial form around the external and the internal condyles, by uniting with the recurrent branches of the radial and ulnar. Thus it is by no means indispensable, as has been long supposed, (Monro, *Méd. de Chir., etc.*, 1826, p. 354,) in order to explain this phenomenon, that the artery at the elbow should be divided into two trunks above the point obliterated. As this caprice of nature, however, happens quite often, the surgeon ought not to forget it. A young man receives a cut from a knife in the lower part of the arm. Having tied the two ends of a large artery, I believe the operation to be terminated, and prepare for dressing. But the hemorrhage reappears. A second artery of the same size as the first was found at the distance of more than half an inch upon the outside of it, and obliged me to tie also the two ends of that.

ARTICLE IV.—THE BRACHIAL ARTERY, PROPERLY SO CALLED.

§ I.—*Anatomy.*

It is in the middle of the bicapital internal groove that the brachial (humérale) artery is situated; its course is indicated by a line drawn from the hollow of the axilla to the middle of the bend of the arm; the median nerve which runs along side of its radial border above, soon covers its outer (or cutaneous) face and crosses it very obliquely in order to get upon its ulnar border far below. Two satellite veins ordinarily accompany it, or sometimes cover it, and thus separate it from the median nerve; the ulnar nerve and the internal cutaneous nerve which approach it above, separate themselves from it more and more as they descend to reach the internal portion of the fore-arm. Resting against the humerus between the coraco-brachialis muscle and the tendon of the latissimus dorsi outside of it, it soon arrives upon the brachialis internus behind the biceps which it accompanies to its termination. In thin subjects the aponeurosis is almost contiguous to it. The whole is covered as elsewhere by the common integuments. Its *anomalies* are so frequent that no one is ignorant of them. I have seen it divide itself into two trunks near the bottom of the axilla, at some inches lower down, at the middle of the arm, above the elbow—in a word, at all parts (hauteurs) of the limb. In one subject one of the branches bifurcated at two inches from the inner condyle to form the ulnar and posterior inter-osseous. In another this last was independent of the radial and of the ulnar. The two trunks sometimes lie side by side with each other down to the fore-arm; at other times they cross each other once or several times; it is not uncommon to see one of them, most usually the ulnar, pierce the aponeurosis and place itself immediately under the skin, while the other which then furnishes the radial and the inter-osseous, preserves its natural relations.

§ II.—*Indications.*

The brachial artery may become the seat of aneurismal affections at every part of its extent almost indifferently; but it is infinitely less disposed to them elsewhere than at the bend of the arm. As nothing interferes with their development, the tumors, to which these diseases give rise, are generally regular, acquire great size in quite a short time, and rest frequently at their central portion over the opening of the artery.

A. Before recurring to the ligature it is sometimes allowable to attempt compression and refrigerants; the humerus here offers a point d'appui which signally favors the advantageous application of these means. It was to a wound of the brachial artery at its upper third that Chappe employed compression with success. M. Lisfranc speaks of a patient who has four aneurisms in the arm, and who, during the space of a year, restricted their growth by means of a laced stocking (bas lacé.) The Queen of Bavaria and another personage of the north were cured of an aneurism of this kind by

M. Winter, by means of a compressing bandage. Also it was not until lately that the practice was determined upon of tying the brachial artery, properly so called. Cheselden scarcely believes the surgeons who told him they had done it. It appears, however, that Laufranc (Portal, *Hist. Anat. et Chir.*, t. I., p. 191) had already recommended it; Morel, (*Jour. des Nouv. Découv.*, t. III., p. 212,) going still farther, performed it in 1681, and S. Formi, (Rivière, *Obs. de Méd.*, p. 628,) as well as Tassin, (*Chirurg. Milit.*, etc., p. 35,) each relate a curious instance of it. We should do wrong, however, to deny the dangers of this ligature. Palsy, says Schmucker, was the consequence of it in one case, though the nerve had been avoided. In a patient of M. Kraemer (Sprenkel, t. VII., p. 348, 349) it gave rise to tetanus. A patient whom I operated upon at La Charité, in 1838, was seized with paralysis at the moment of the operation; but it is necessary to remark that in him the wound had seriously implicated the soft parts of the neighborhood. M. Arbey, (*Dissert. Citée*, Strasbourg,) who, for a wound from a ball, placed his ligature in the upper third of the arm, found gangrene supervene, and was obliged to amputate.

B. It is nevertheless upon the humeral artery that the operation for aneurism is most frequently performed, and upon which *agopression*, devised by M. Giaccich, (*Agopressure*, &c., Mai 1837,) might be made trial of. There the vessel is superficial, easy to seize and surrounded by parts that are sound and not changed, while in front of the articulation the presence of the aneurism so masks its position that we sometimes have much difficulty in identifying it. Nevertheless we ought, as a general rule, to apply the ligature here as low down as the disease will permit. No circumstance apparently with the exception of a diffused aneurism and a fresh bleeding wound would justify a preference for the ancient method. If the aneurism extended too high up we should decide rather upon tying the axillary in the hollow which bears its name, unless it should be judged advisable to put into practice the method of Brasdor.

§ III.—Operative Process.

A. The limb being placed as before described, and properly kept apart from the body, the operator seeks for the groove of the biceps, carries the bistoury, in the direction of the arterial line from above downwards, if it is the right arm, and from below upwards if it is the left, and makes an incision of from two to three inches through the integuments. Immediately after, he places his left fore-finger in the wound, endeavors to feel the median nerve which presents itself under the form of a rounded cord of considerable firmness, and to distinguish it from the artery which is recognised by its pulsations; afterwards dividing successively upon the director, the aponeurosis and the sheath which it gives to the nerve, he tears, and always with the point of the sound the cellulo-fibrous envelope of the vessels; isolates the artery from the veins which surround it, and applies the ligature. This operation

can only become difficult in consequence of an anomaly or change in the relations of the parts which it is important not to confound. The median nerve is the first cord that presents itself behind the biceps muscle; I have but once seen it under the artery, between that and the brachialis internus muscle. When we have once identified it, we may be sure the vessels are not far off.

B. Since in a young man who came to La Charité, in 1837, it was found sufficient to compress the brachial artery for the space of twelve hours to avoid the necessity of a ligature upon the ulnar which had been wounded; and since, in the case of M. Wythe-roeven, a strangulation of thirty-six hours produced the same result after a lesion of the arteries of the arm, we may understand how the temporary ligature has in such cases succeeded with M. Malago (*Bull. de Férussac*, t. XVIII., p. 82,) who removed it upon the fourth day; with M. Bologna, (*Jour. des Progrès*, t. XVII., p. 248,) who left it on only three days; and with M. Dolcini, (*Bull. de Férussac*, t. II., p. 334,) who also removed it on the fourth day.

C. Shall I add that Formi used only the indirect ligature, and that Buron (Tassin, *Chir. Milit.*, p. 35) succeeded in the same manner with the following case? In a sword-cut the artery was opened between the two wounds, that is, at the middle part of the arm. It was eight days before it was perceived that the artery was wounded. At the expiration of this period, during a fit of passion of the patient, the artery bled afresh, (s'ouvre,) and all the remedies proved unavailing. Buron pierced the arm in the belly of the biceps near the bone, with a carlet threaded with a double ligature, which he tied tightly upon compresses. To prevent mortification he slackened the ligature on the day after, and so on successively on the following days. The patient was cured.

D.—When the brachial artery is obliterated, the circulation is re-established below it, by means of the muscular branches which it gives off throughout its whole length, by the great collateral or external collateral artery, and by the great anastomosing branch, when it has not been sacrificed.

[ANEURISMAL VARIX AND VARICOSE ANEURISM.]

*Simultaneous Existence of Aneurismal Varix and Varicose Aneurism from Venesection, and their Successful Treatment by Ligature.—Diagnostic Marks, by which they may be distinguished from each other, and from other Aneurisms.—Aneurismal Varix, (Varice Anéurysmale,) and Varicose Aneurism, (Anéurysine Variqueux,) being two distinct affections of a traumatic character, resulting most usually either alone or together, from wounds of the brachial artery in the operation of bleeding, and being phrases also that are frequently confounded together, we avail ourselves, in further illustration of what has been so clearly stated in the text of the author, of a recent memoir on the subject by M. Auguste Bérard, read Aug. 15, 1843, to the Société de Chirurgie of Paris, and published in the *Archives Générales de Médecine de Paris*, (Janvier, 1845, p. 38, et seq.*

It is necessary to premise, before proceeding to the observations of M. Bérard, that, with English and American surgeons, the phrase *varicose aneurism* is now very frequently applied to that peculiar congeries of dilated branches of vessels, including chiefly the veins, and probably also the minute arterial and venous capillaries, which, in common parlance, is called a *nævus maternus*, and by some a species of erectile tumor. In French, however, *varicose aneurism*, or *anéurysme variqueux*, has generally, as we shall see, a very different signification.

1. *Of Varice Anéurysmale, or Aneurismal Varix.*—In this case, the brachial artery, for example, being wounded and opened by the same perforation, which was made through one of the veins in its immediate vicinity, the blood effects a passage directly from the artery into the vein. This last undergoes a dilatation which occupies the neighborhood of the wound, or extends itself to a greater or less length through the wounded vein and the branches which it receives.

2. In other cases, a tumor is formed which is bounded by the cellular tissue, and into which the arterial blood penetrates in a manner similar to what takes place in false consecutive aneurism, but with characters peculiar to it. This is called *varicose aneurism*, or *anéurysme variqueux*. "These characters, as described by authors, are," says M. Bérard, "as follows: A canal of greater or less length, from the artery to the vein, establishes the communication between these two vessels. On some point of this canal there is a dilatation formed at the expense of the cellular tissue: sometimes this sac occupies the entire circumference of the canal; at other times it is confined to a portion only of its periphery."

This kind of lesion, which is much less frequent than aneurismal varix, has, M. Bérard asserts, not been submitted to dissection, except by two or three persons; and all authors who have treated of it, have repeated the description which has been given by their predecessors. From whence it is natural to conclude that the pathological anatomy of *varicose aneurism* is not as yet perfectly understood, as it is easy to conceive that other forms of this disease may be presented. As an example, he gives a modification which he thinks has hitherto escaped observation. A patient aged 40, who had been accustomed to be bled frequently for pains in the head, had the brachial artery wounded April 13, 1840. A compressing bandage, applied by the physician in attendance, proved of no avail, and the next day the patient experienced acute pains in the bend of the arm, with a burning sensation along the track of the vessels. On relaxing the bandage, the limb soon began to swell, the tumefaction extending to the shoulder and wrist, and the skin successively assuming first a yellowish, then a brown and violet, and finally a black color. Pulsations soon became perceptible at the bend and lower part of the arm. For many days the suffering was acute from the axilla down to the fingers, requiring opiates externally and internally, and rendering the arm heavy and incapable of obeying its voluntary movements. The tumefaction

now began gradually to diminish ; but in proportion as it subsided, it became easier and easier to define at the bend of the arm and at the inner and anterior part of the biceps, a soft fluctuating tumor, with pulsations isochronous with those of the arteries, and partially reducible when pressure was made on the brachial artery. The pulsation then began to cease in the middle of the tumor, and the sac to become filled with coagulated blood ; moreover, there was no vein running from (ne faisant suite) this tumor. The entrance of the blood into the pouch (or sac) was accompanied by a rasping sound, (*bruit de frottement*,) which was readily perceptible on applying the ear to it. Outside of, and under the tumor towards the fore-arm, there was also perceptible an audible similar sound, (*bruissement analogue*,) which was propagated along the veins to the distance of 8 to 10 centimeters. An analogous sound, though of less strength, could also be detected along the brachial vein as far as the lower third of the arm. The patient was also conscious of this sound, which could be recognised by the surgeon with the greatest ease, by exploring it with his finger. If the ear was applied to these several points, there was then heard the pathognomonic bruit of the passage of the arterial blood into the veins—a sound which has been compared to that of a spinning wheel, (*rouet à filer*,) the hum of a bee, (*bourdonnement de l'abeille*,) or the murmuring (*susurrus*) of a stream, &c. This bruit was entirely different from that heard at the tumor at the bend of the arm.

“It was impossible for me,” says M. Bérard, “to misunderstand these symptoms as those of aneurismal varix combined with those of varicose aneurism. The last mentioned lesion particularly excited my attention, and I in vain endeavored to arrest its progress, by compression, repose, &c.” The tumor from day to day acquired additional size, and on the 13th of May, (that is, a month after the accident,) he performed the operation for aneurism.

Notwithstanding the difficulties of the ancient method, which are augmented by the communication of the artery with the veins, he decidedly prefers it to the inadequate and dangerous method (as he denominates it) of Auel and Hunter in cases of this description. The brachial artery having been compressed at the upper third of the arm, in such manner as to intercept the passage of the blood into the tumor, an incision of 7 to 8 centimeters was made at the bend of the arm in the track of the artery. The anterior part of the sac and the aponeurosis of the fore-arm were laid bare and divided to the same extent as the skin. At the instant of opening the sac, there flowed out from it fluid blood mingled with a large quantity of fibrinous clots, some of which were dense and adherent to the internal surface of the sac. “I then searched,” says M. Bérard, “for the upper end of the artery, which I found behind the posterior wall of the sac, and which I easily succeeded in separating from the vein, which was found lying between the artery and the sac.”

This first ligature was applied at about the distance of two cen-

timeters from the point from which the blood was seen to escape from the bottom of the wound.

Though the ligature was tightened, the blood continued to flow; it was black when the brachial artery was compressed at its origin, and became both arterial and venous when this compression was taken off. This fact left no doubt of the reflux of the blood from the lower end of the artery, by means of the internal and external collateral and the articular arteries. I sought for the lower end of the vessel, but experienced the greatest difficulty in finding it. The cellular tissue was thick, indurated, and red, and the vein closely united to the artery. In order to separate them with more ease, I tried to insert a probe into the last mentioned of these two vessels. For that purpose, I applied the instrument to the bottom of the sac where the blood made its escape, and made it pass through the wound which the lancet had made in the vein. The probe was passed from above downwards in this vessel. I made a new effort to insinuate it into the artery, and I found that, in order to effect this, I had to pass through the vein from one side to the other. In fact, the situation of the parts was as follows: deep down the artery presented on its anterior surface a large and almost transverse wound, which occupied more than half the circumference of the vessel; in front of the artery was the vein, which was closely (*immédiatement*) united to it; this last (the vein) presented, on its posterior surface, a wound similar to that of the artery with which it was in exact coaptation; on its anterior surface was another wound of the same form and dimensions; finally, in front of the vein was the aneurismal sac, which communicated with the vein by the anterior wound of this vessel, so that it received indirectly only (*que médiatement*) the blood which came to it from the artery.

The walls of the vein appeared thick, especially a little below (*au dessous*) the puncture. The adhesion of the vein with the artery at this point was so close, that I found it impossible to separate them, and was obliged to *include both vessels in the same ligature*.

As soon as this was done, the blood ceased to flow, and I ascertained again that the condition of the parts was such as I have just described them.

The consequences of the operation presented nothing remarkable, but were very simple. The circulation was re-established the day after, in the radial artery. The two ligatures came away, the upper on the thirtieth, and the lower on the thirty-fourth day. Finally the wound was completely cicatrized at the expiration of six weeks. There remained afterwards only a slight weakness in the limb, and some inconvenience in the movement of extension of the fore-arm, both of which soon entirely disappeared.

This case, continues the Professor, exhibits varicose aneurism in a different point of view from that under which it has hitherto been considered. The artery and the vein were completely agglutinated (*entièrement collées*) together, and communicated with each other

by an opening of no greater length than that which belonged to the thickness of their united (adossée) walls. But on the other side of the vein, between this vessel and the integuments, was an aneurismal pouch occupying the bend of the arm and extending itself (upwards) to the lower region of the arm. This sac, which was full of arterial blood, and which had all the characters of false consecutive aneurisms, communicated with the vein by an opening which was situated directly in front of that which united the vein to the artery.

Though this arrangement differs totally from the descriptions that have been given up to the present time, the manner in which it was brought about seems to me susceptible of easy explanation, one much more simple also than that which authors have given. What in truth is the lesion caused at the moment of bleeding? A simultaneous wound of the artery and the vein; the latter is pierced through and through; one of its wounds, viz., that which is made in its posterior (profonde) wall, remains gaping and becomes united with that of the artery: if the first [i. e., the external wound on the anterior surface of the vein—T.] should cicatrize, an *aneurismal varix* only is produced; but if the projection of arterial blood into the vein is energetic, this fluid traverses the calibre of the vein, penetrates through the anterior (opposée) wound of this vessel, and the wound of the integuments, however little compression may be made upon it, heals, while the blood at the same time hollows out for itself a pouch in front of the vein and at the expense of the cellular tissue which envelopes it; and in this manner there is established an aneurismal sac which will present the symptoms and progress of false consecutive aneurism. It differs however from this last, in these particulars; 1, that its walls are not formed by the external coat or cellular sheath of the arteries; and 2, that the opening by which it communicates with the arterial system, is not made in a direct manner, but through the intervention of the vein.

I have remarked, says M. Bérard in conclusion, that the mechanism of the formation of this kind of varicose aneurism was more easily explained than the other; in fact in this last we are obliged to admit that a canal of greater or less length exists between the artery and the vein: but a condition which is considered, if not indispensable, at least very usual in the formation of an aneurismal varix, is the agglutination (l'accollement) of the vein with the artery at the point where the two vessels are wounded. Now if a varicose aneurism should make its appearance at a later period, we are forced to admit that the two vessels are separated and detached from each other; a result not easy to be explained. From these considerations, I am induced to believe that the form of varicose aneurism which I have discovered, is not new, and that it must have passed unnoticed in other cases. Having now pointed it out to the attention of surgeons, future dissections will invalidate or confirm the ideas which I have submitted to the judgment of the society.

Remarks.—There is a precision of language, a clearness of ana-

tomical description, a force of reasoning in the communication of M. Bérard, which are of themselves calculated to carry conviction to the mind, as to the accuracy of all his conclusions; and we mistake greatly, if a contribution like this upon a common yet hitherto almost unexplored point in surgical relations, pathology and treatment will not be generally deemed by the profession of the highest value. It was for such reasons that we have endeavoured to incorporate the whole substance of this surgeon's remarks with the text of this work.

The distinctions between several phrases, but little or very imperfectly understood, will we trust no longer lead to any confusion of the mind, especially as to the duty to be performed when young practitioners, already presumed to be thoroughly acquainted with the anatomy of the parts shall be suddenly called to such exigencies as they must expect to be from the carelessness and ignorance too often manifested in venesection; an operation, which even in this country, at the seat of its first great medical school (Philadelphia,) is still often performed by respectable medical men with a rude instrument called the *spring lancet*, used by veterinary practitioners, and which is so well calculated to divide both vein and artery as well as other deep-seated and unseen parts with one clip of its uncontrolled blade.

The student should always keep before the mind the exact anatomy of the parts and the anomalous course which the vessels sometimes take; (Vol. I. and II.); and with such advantages as the precautions so forcibly inculcated in the text by M. Velpeau, and with the important auxiliary information to be derived from a monograph like that of M. Bérard above, we cannot conceive how he can hereafter fail to comprehend with all the distinctness required: 1. What constitutes (a) an *aneurismal varix*; (b) a *varicose aneurism*; (c) a *false consecutive aneurism*; or (d) a *false diffused aneurism*, and how all of them may be contradistinguished from (c) a *legitimate spontaneous aneurismal sac* or pouch, whatever may be the shape or situation of this last, or what its apertures or modes of communication with the arterial trunks involved. 2. Nor find any difficulty in understanding how an *aneurismal varix* may exist alone, or at the same time and place with a *varicose aneurism*, or how a *traumatic aneurism* may involve the wound of a principal artery *only*, and form a *false consecutive diffused*, or a *false consecutive circumscribed aneurism*—the first similar to the varicose aneurism, and the last differing from it in the characters, as pointed out by M. Bérard; and both differing again from *varicose aneurism* properly so called, in this—that the contained fluid in all false aneurisms is almost exclusively *arterial*, and not as in true varicose aneurism, and also more strictly in aneurismal varix, a combination of venous and arterial blood.

There is another important point to be attended to by the practitioner, as well as by the student in the memoir of M. Bérard: that is, the admirable opportunity which diseased organic structures so superficially placed, so isolated and so perfectly at our

command, as it were, furnish, (as is seen in his lucid description of the various kinds of *bruit* of these aneurisms,) to put auscultation to the test, and extract from it all the real value it may possess as a guide for our researches, for example, into substernal and thoracic aneurisms—to say nothing of the light it may throw on the still more obscure and contradictory, though so often examined subject of auscultation as applied to diseases of the lungs.

Varicose Aneurism at the bend of the arm in bleeding, cured by pressure.—Mr. Liston, (See his lectures, London Lancet, Dec. 21, 1844, p. 361,) says he has seen *several cases of aneurism at the bend of the arm* from the operation of bleeding, [whether varicose aneurism or aneurismal varix, or both, he does not specify. T.] completely cured, if acted upon immediately, and before the blood is much effused into the cellular tissue. This cure consists in strong compression, beginning with the roller bandage upon each finger separately, and passing around the hand, in the palm of which must be placed a compress. You proceed firmly with the turns upwards, till you reach the wound, over which, after having properly adjusted upon it, first a small, and then three or four other compresses in order to obtain a proper elevation for them, you twist the remaining turns tightly over these, and in all probability, he says, you will prevent an aneurism.

But when aneurism is formed, it will do so speedily by the *astonishingly rapid condensation of the cellular tissue*, by which means a regular cyst is produced. I have, says Mr. Liston, a preparation of an aneurism of two or three days' growth, with as regular and beautiful a cyst, as you would wish to see in any aneurism.

Cure by Pressure.—Mr. Liston believes that such aneurisms are sometimes cured by pressure; which should be made by bandaging the lower part of the limb, by which means the patient will be enabled to bear the pressure of a sort of ring-tourniquet on the brachial artery, maintained by a proper apparatus, which admits of being regulated by the patient himself. In conformity with the sound views of pathology adopted by the Dublin surgeons, in the cure of aneurisms by compression, (See our note on compression,) Mr. Liston says, *it is only necessary to retard the flow of blood into the tumor, so as to favor coagulation of its contents*; and this is to be effected by *continued but not violent compression*.

Mr. Liston says, he has seen more than one aneurism disappear in consequence of the application of pressure. One was a case of brachial aneurism, where the pressure was made *on the tumor itself*, (See similar case in our note on Mr. Luke's case of tubular femoral aneurism.)—Mr. Oldknow, according to Mr. Liston, (Ib. loc. cit.) a surgeon of Nottingham of extensive practice, had a similar case cured in the same way.

There is no doubt, says Mr. Liston, that much is to be done for aneurism, in some situations, by pressure well applied.

Where however, you have for such accidents to resort to ligature on the brachial on the arm above, be careful to ascertain, while the artery is raised up from the edge of the biceps, that it is the trunk

which you will know by pressure upon it suspending pulsation in the tumor. Otherwise from the occasional high division of the brachial you may tie only the ulnar.

But where the tumor from the anastomosis being so strong is not diminished, the ligature on the trunk of the brachial itself will not answer, and we are then to cut down on the tumor itself, and tie both ends of the wounded vessel, (See M. A. Bérard's lucid account of these aneurisms, above.) This M. Liston thinks the best plan in a recent aneurism in this part; also where pressure had been imperfectly made on such aneurism, or ulceration had taken place over the tumor, producing alarming hemorrhage.

In wounds of the hand, laceration or evulsion of the thumb, or one or more fingers, where the superficial palmar branch has been wounded, and pressure proves ineffectual in preventing extensive tumefaction of the parts, inflammation, diffused aneurism, abscess, severe and repeated hemorrhages, &c., from effusion and infiltration of blood from the wound, M. Liston thinks, (London Lancet, Dec. 21, 1844, p. 362—363,) the best plan is to tie the brachial at once. It will not do to tie the radial or ulnar or both, for blood will still be furnished from the deep-seated palmar arch, by means of the inter-osseous.

The Brachial Artery Ruptured.—A case is related, (Lond. Med. Gaz., May 16, 1845, p. 130,) in which the brachial artery was found ruptured and the upper extremity of the divided vessel retracted high up in the axilla. This accident occurred in a young man aged 18, from fracture of the head of the humerus and glenoid cavity, with protrusion of this extremity of the bone, caused by the arm being caught in machinery. The patient was received into the infirmary of Newcastle-upon-Tyne, and died of erysipelatous symptoms occasioned by the injury, without any attempt being made to disarticulate the bone or to place a ligature on the upper extremity of the ruptured vessel.

Spontaneous aneurism at the bend of the arm.—Mr. Liston, (Lond. Lancet, Dec. 21, 1844, p. 361,) has seen but *one* case of true spontaneous aneurism, (i. e., Scarpa's, he means, or the giving way of the internal coats and dilatation of the external ones,) at the bend of the arm, viz. : in a stout middle aged man who attributed it to the use of the arm in wielding a mallet in driving bolts. From incautious blood-letting aneurism formerly occurred here quite often, and it does occur still from that cause. T.]

ARTICLE V.—AXILLARY ARTERIES.

§ I.—Anatomy.

Under the name of axillary artery I shall speak only of that portion of the arterial trunk, which extends from the clavicle to a level with the lower border of the great pectoral muscle. We may regard it in two points of view, either in the *hollow*, or on the *anterior surface* of the axilla.

A. In the first it is separated from the skin, only by the two roots of the median nerve, this nerve itself, the axillary vein, a cellular filamentous and adipose layer of tissue, increasing in thickness as we approach the apex of the axilla, and by the aponeurosis and a second cellular layer. The thoracic, sub-scapular, &c., cross it, and conceal it at different points; the other nerves of the brachial plexus, at first situated in front of it, soon pass behind it to reach the ulnar side of the arm. Outwardly it rests against the tendon of the sub-scapularis muscle, and the scapulo-humeral articulation, the head and neck of the humerus, between the tendon of the teres major, which is behind, and the pectoralis minor, or the coraco-brachialis, which are in front.

B. In its other portion, (i. e., on the anterior surface of the axilla,) it is situated at a much greater distance from the skin; the pectoralis minor crosses it at two or three inches in front of the clavicle; a fibro-cellular membrane, (toile) sometimes quite dense, conceals its position, (plan,) and separates it from the pectoralis major muscle. The vein is situated upon the inside, and towards the chest, and the anterior root of the median nerve upon the outside and towards the shoulder, so that both, in part, cover the artery, which is in the interval, and a little behind; an arrangement nearly constant, and which may prove of the greatest assistance in the operation. The cephalic vein, as well as those which go from the stump (moignon) of the shoulder, to empty themselves into the axillary vein, below the clavicle, are obliged to cross its anterior surface. It is the same with one or two thoracic branches of the nervous plexus: the axillary artery gives off the acromial artery, and the principal external thoracic artery, before passing under the pectoralis minor muscle.

C. Lower down the median nerve is, in front, the ulnar outside, the radial behind, and the vein on the inner side of the artery, so that it is found almost completely surrounded by those parts, to which it is also united by a cellulo-fibrous sheath of considerable firmness.

§ II.—*Indications.*

Aneurisms and wounds of the axillary artery claim the most serious attention. Though less frequent than at the ham, groin, and bend of the arm, they are more so than on any other points of the limbs; which is explained by the position and size of the vessel, its relations with the articulation, and its proximity to the heart. All kinds of aneurisms are found on this artery, even varicose aneurism has been seen here by M. Larrey, (*Clin. Chir.*, t. III., p. 142,) Dupuytren, and M. Pl. Portal, (*Op. Cit.*, p. 204.) The reaction which they produce on the nerves, veins, and ganglions, and on the articulation, and on all the surrounding parts, make aneurisms of the axilla a serious disease, which has long been a source of apprehension to surgeons, and was generally looked upon as beyond the resources of art, until at the conclusion of the last century.

A.—Van Swieten, (*Comment.*, t. I., § 161,) however, had already mentioned a traumatic aneurism in this region, which got well spontaneously, without necessitating the loss of the limb. M. S. Cooper also mentions a patient in St. Bartholomew's hospital, who was cured of an aneurismal tumor in the axilla, without any assistance. Sabatier effected the dispersion of another by the method of Valsalva, and refrigerants. But the patient was less fortunate in the following case reported by Chabert: (*Obs. de Chirurgie*, p. 95; *Obs.* 41, 1724, in-12,) from the cut of a sword a slight hemorrhage took place an hour after the wound; a second hemorrhage on the eighth day, and a third on the eighteenth; the treatment was incision, compression, vitriol, &c. On the twenty-fifth day a fourth hemorrhage, to a considerable extent; on the twenty-ninth day a fifth hemorrhage. The jet of blood equalled the size of the thumb, and was followed by instant death. The artery being laid open lengthwise, was found dilated and engorged with coagulated blood up to the first rib.

Hall, about the middle of the last century, and Keate, in 1801, tied the axillary artery with entire success. This operation, which was then thought new, was not so. A surgeon of La Charité, Morel, (*Jour. des Nouv. Découv.*, 1681, t. III., p. 70–75, *Zodiac Méd.*, t. II., p. 25,) of whom Saviard often speaks, had performed it with success for an aneurism, before 1681. Another surgeon, Baader, (Portal, *Anat. Méd.*, t. III., p. 233,) according to Portal, also had recourse to it in the last century. There is also a case of it in Formi, (Bonet, *Corps de Méd.*, t. IV., p. 191,) who says that the ligature was required for a wound. But in this case it was rather the brachial than the axillary, to which an indirect ligature was applied. It is, therefore, no longer allowable to think of amputation in the joint for this disease, as Gooch still advises, and as was the practice before the modern labors on this subject, nor can I, in reality, decide if it was more indispensable in the case of diffused aneurism, published in 1812, by M. Debaig, (*Thèse* No. 144, Paris, 1812,) than in the case which was published by M. Auchincloss, (*Edinburgh Medical and Surg. Journ.*, April, 1836, p. 332,) in 1836.

The cures obtained through the aid of the system, the reducing treatment, digitalis, purgatives, or cold topical applications, are too uncertain, as it seems to me, and in too small number to authorize us to depend upon them. The operation, which is incomparably more sure, should be preferred as often as it is practicable. White (J. Bell, *Trait. des Plaies*, trad. Franç., p. 81) attempted it, it is true, without success. The limb was attacked with gangrene, but the nervous plexus had been included in the ligature. Desault (*Œuvres Chir.*, t. II., p. 52) met with the same misfortune; but he embraced also, in a first ligature, the whole brachial plexus. In another case he could not master a hemorrhage, which soon terminated fatally. In the case of Pelletan (*Clin. Chir.*, t. II., p. 52) the whole thickness of the armpit was traversed by a needle, and the artery was not secured (*saisé*.) Another attempt of Desault is related, in which he was equally unsuccessful. M. Roux says, that a patient

died at the hospital of Beaujon, in consequence of a similar attempt. Delpech, who thought it advisable to cut through the pectoralis minor transversely, and to raise the whole axillary plexus with the left fore-finger, curved as a hook, in order the better to isolate the artery, was not more fortunate in 1814. The patient of M. Blasius (*Arch. Gén. de Méd.*, 2e série., t. IV., p. 140) died at the expiration of two hours, and the autopsy did not enable them to discover the arterial branch, which gave place to such repeated hemorrhages. It was necessary to have recourse to the Bonnafoux powder, and to compression above the clavicle, to arrest a hemorrhage, on the eighteenth day, in the case related by M. Castanoso, (*Lanc. Fr.*, t. XII., p. 192.) But these unfortunate cases prove nothing against the operation; the fault is in the processes employed, or in the unfavorable circumstances in which the patients were then placed at the time. To the successful cases mentioned above, we may add others which belong to M. Maunoir, MM. Chamberlaine, Monteith, (*The Lancet*, t. I., p. 730,) Roux, (H. Bérard, *Dict. de Méd.*, 2d edit., p. 497) and H. Bérard.

§ III.—Operative Process.

A. *Ancient Method, or by the Hollow of the Axilla.* If there should remain a free space above the tumor, or that the case should be one of a simple wound in the apex of the axilla, it would be better, as M. Hall, M. Maunoir, M. Blandin, and M. Bérard, have done, to seek for the artery in the hollow of the axilla, than to divide the anterior wall of this cavity.

I. The patient being laid upon his back, and the limb held apart from the body as far as possible, we make an incision of three inches in extent, parallel to the vessels, and a little nearer to the anterior than to the posterior wall of the axilla; the skin, a cellular tissue, and a filamentous aponeurosis, present themselves successively, as in the arm. The sound performs the rest of the operation; its point pushes the median nerve forward and outward, afterwards glides behind the artery, to separate it from the ulnar and radial nerves, raises it up a little, to pass between it and the vein, which latter, the nail of the fore-finger, or thumb of the other hand, endeavors to push aside inwards and backwards.

II. The patient, of whom G. Bell speaks, had received a cut from a scythe, and was found in a state of syncope, which had suspended the hemorrhage. Hall, (Bell, *Oper. Citat.*, p. 82,) in consequence, confined himself to seizing and tying the upper end of the artery. The patient of Maunoir had received a sabre cut; the wound was merely dilated, and the surgeon applied one ligature above, and then another under the wound of the vessel. M. Blandin, (*Thèse de Concours*, 1833, p. 5,) who operated for a gun-shot wound does not say what became of his patient; but a patient in whom the brachial artery divided by a ball, gave rise to repeated hemorrhages, and which compelled M. H. Bérard (*Archiv. Gén. de Méd.*, 2e série., t. VII., p. 442) to tie the trunk of the axillary artery by

this process, recovered perfectly. Moreover, it is evident that for an aneurism, properly so called, the method, by the opening of the sac, would here be very dangerous, and too dangerous, in fact, in any case, to be resorted to.

B. *The new method, or in front of the axilla.* When it is not possible to employ the process which I have described, ought we to penetrate in front of the axilla? Would it not be better, and more prudent, to endeavor to find the subclavian behind the clavicle, or would it not be as well to make trial of the method of Brasdor, by applying the ligature below the tumor? This double question appears to me to be easy of solution. If the tumor occupies the hollow of the axilla, we must cut down at the supra-clavicular depression. It would be difficult to find a sound portion of the artery in operating below the clavicle. If, on the contrary, there remains a void above the aneurism, it is by the apex and hollow of the axilla that we must arrive at the vessel, the same as if it was a case of wound. I come to the conclusion, therefore, that the ligature upon the axillary artery, through the anterior wall of the axilla, is useless, and ought not to be attempted. If the sac was sufficiently high up to allow of placing the ligature between its lower extremity and the origin of the circumflex arteries, and the common scapular artery, we might have every possible chance of success, by adopting the process of Brasdor. On the supposition, however, that the surgeon should decide on applying the ligature through the anterior wall of the axilla; there are a number of processes by which this may be accomplished.

I. *Process of Desault.*—Desault incised the soft parts within the *coraco-deltoid* line, and cut the pectoralis major upon the grooved sound; in case of necessity, we should divide the pectoralis minor itself, in order to lay bare the whole of the brachial plexus, to seize it with the thumb and fore-finger of the left hand, and to isolate the artery carefully from it as low down as possible. It would not, it is true, be absolutely indispensable to adopt this process, made more exact in other respects by the new description which M. Marchal (*Thèse* No. 156, p. 14, Paris, 1837,) has given of it, except we wished to operate by opening the sac; but if it was prudent or possible to tie the axillary artery above the tumor at this line, and that we should not wish to penetrate by the hollow of the axilla, it might still be admissible. Though adopted by Delpeau in 1814, and though others have put it in practice since, I do not, however, think we ought to consider this, or those that follow, in any other light than as cases of extreme necessity, or the last resource at our command.

II. *Process of Keate.*—The incision of M. Keate was directed obliquely downwards and outward; it included a part of the pectoralis major, without dividing it entirely through; but the first ligature was applied too low down, and it became necessary to have recourse to a second one, quite near the clavicle, which probably would not have happened, if, before passing a curved needle

into the bottom of the wound, M. Keate had taken the precaution to isolate the artery with a grooved sound.

III. *Process of M. Chamberlaine or of Pelletan.*—The course of M. Chamberlaine, in other respects conformable to the first proposition of Pelletan, was more systematic and reasonable. This surgeon judged it advisable, first, to make a transverse incision three inches long on the fore part of the clavicle; he then made a second, of the same length, parallel to the cellular line which separates the pectoralis major from the deltoid, turned down (*dejeta*) the triangle circumscribed by this incision of an L reversed, and the artery, which he recognised by its pulsations, then presented itself to view: an eyed-sound served for passing the ligature. This was the 17th of January, 1815, and on the 22d of February the cure was completed.

IV. *Process of M. Hodgson.*—M. Hodgson rejected this double incision. According to him, (and M. S. Cooper adopts his opinion,) the best method consists in cutting a semi-lunar flap, with the convexity downwards and the extremities of which, separated by an interval of three inches, correspond with the clavicle, near the sternum inwardly and to the acromion outwardly. After having raised up this flap, which comprises the whole thickness of the pectoralis major, the upper triangle of the axilla remains free, and the artery may be easily isolated and seized between the clavicle and the pectoralis minor muscle. Nevertheless, we may reproach M. Hodgson, as well as M. Chamberlaine, with uselessly sacrificing a great portion of the pectoral and deltoid muscles; so that in France a process has been specially recommended, which is nearly similar to that which M. Ch. Bell describes and figures, being the same nearly as that of Keate.

V. *Ordinary Process.*—The limb is first slightly held apart from the trunk, and the shoulder thrown downwards (*dejetée*) and a little backwards.

a. *First Stage, (premier temps.)*—The surgeon, placed between the chest and the arm, commences the incision at two fingers' width outside of the sterno-clavicular articulation, and prolongs it to below the coracoid process, in the direction of the fibrous bundles (*faisceaux*) of the pectoralis major muscle, taking care to stop at some lines from the deltoid interstices. If any small artery (*artéριολε*) should show itself under the skin, the ligature should be immediately applied to it; the fleshy fibres should be gradually separated by the bistoury, rather than divided by it; a yellowish layer is then very distinctly seen, which shows that the muscle has been divided, the fibres of which are then relaxed by depressing the limb a little, in order the more easily to keep apart, or cause to be kept apart, the lips of the wound.

b. *Second Stage.*—However little danger there may be of wounding any vessels, the sound should be made to replace the cutting instrument. With its extremity we tear the adipose or cellular layer and the coraco-clavicular aponeurosis, while the left fore-

finger, curved as a hook, depresses and forcibly pushes down the upper border of the pectoralis minor. The eye soon sees either the vein, which is recognised by its size and its blueish aspect, or the first nervous branch of the brachial plexus.

c. Third Stage.—In order to find the artery which is between and behind these two cords, [i. e., the vein and nerve above. T.] the sound is carried to the outer side of the vein, which is to be pushed a little towards the thorax; then, by movements forwards and backwards, we make the extremity of the instrument penetrate perpendicularly to the depth of four to six lines, so that in elevating it from behind forwards and from within outwards, it does not fail to bring up the arterial trunk, from which we then separate the nerve with the finger or the point of another sound.

d. This process, which appears so simple on the dead body, and which I have considered the best, is nevertheless the most difficult of all upon living man. Convinced, as we are at the present time, of the little danger there is in wounds of the muscles, I should not hesitate to prefer, instead of this process, that of MM. Hodgson, Chamberlaine, Manec, or Marchal, if I were obliged to apply a ligature in this region to the trunk of the axillary artery.

VI. With these precautions, the secondary vessels and the nervous filaments, on the dead body at least, are easily avoided, and the axillary artery reached with certainty. By placing the ligature immediately below the cephalic vein, we are almost sure of encircling the axillary artery between the acromials which we leave above, and the external thoracic which are found below. The supplemental branches, charged with keeping up the circulation in the limb after this operation, are, the acromial, the subscapular, the transverse cervical, the internal mammary, and some others less important, which all anastomose with the circumflex, the common scapular, and the internal mammary.

[*Ligature on the Axillary Artery or Axillary Portion of the Subclavian.*—Instead of tying the subclavian for wounds of the axillary portion of this artery, Mr. Liston prefers tying both the divided ends of this last portion, (*Lond. Lancet*, Dec. 21, 1844, p. 361,) if called in time. You can tie immediately under the clavicle in the first part of its course, or low down. In the middle portion, he considers it difficult, from the nerves interlacing it. You reach the vessel by dividing freely the fibres of the pectoralis major in the direction of their course. If the artery is wounded in the lower third, you cut down under the border of the pectoral, by which you may tie it pretty high up in the axilla, without interfering at all with the muscular fibres.

[*Ligature on the Axillary Artery below the Clavicle.*—The right axillary artery was tied in Sept., 1842, (*Ann. de la Chir. F. et E.*, Jan., 1843, and *Cormack's London & Edinb. Month. Jour.*, May, 1843, p. 473,) at Messina, (island of Sicily,) by Dr. Catanoso, in a peasant aged 33, who, in falling from a tree, had lacerated the vessel by receiving a wound in the axilla from the pointed branch of a limb, causing considerable hemorrhage, which was controlled

at first by ice and other applications; but recurring afterwards, it was thought advisable to perform the operation, which was effected on the 11th day from the accident. The incision was carried from the inner edge of the deltoid muscle, along and under the edge of the clavicle, to within about an inch of the sterno-clavicular articulation. The upper edge of the pectoralis minor was now seen, and immediately above this the artery was found pulsating. Finally it was isolated, and secured by means of a fine silk ligature, which was cut off close to the knot. On tightening the ligature, the brachial and radial arteries ceased to beat, and the whole extremity became cold. It was rolled tightly in flannel. Next day the limb was found warmer; but after a continuance of favorable symptoms till the 19th day after the operation, secondary hemorrhage ensued, which was arrested by compression upon the subclavian; this hemorrhage having occurred while the dressings were being removed from the wound, at the bottom of which the blood was seen jetting out from a hole of about the size of a goose-quill. Plugging ultimately, completely arrested the hemorrhage, but the wound healed slowly, and the arm, for a long time after the cure, remained somewhat atrophied and impaired in its movements. T.]

ARTICLE VI.—THE SUBCLAVIAN ARTERY.

§ I. *Anatomy.*

Many authors have described the axillary artery as composed of two portions: the one, that which I have just examined, situated under the clavicle; the other, between this bone and the scaleni muscles. Nothing can justify such an abuse of anatomical language, which I regret to find still sanctioned in an excellent article of M. H. Bérard, (*Dict. de Méd.*, t. IV., art. Axillaire, 2d edit.) The arterial trunk of the arm (*tronc brachial*) ought not to take the name of axillary until it enters into the axilla; up to that point the proper name for it is the subclavian artery. I see, with pleasure, that M. Cruveilhier has adopted this opinion, any other than which leads, in fact, to error and confusion.

A.—*Within the scaleni muscles*, the subclavian artery, which is extremely short on the right side because of the brachio-cephalic trunk, has on its posterior surface some filaments of the great sympathetic, then the pneumo-gastric, the phrenic and the branch of the pneumo-gastric which connects the second with the third cervical ganglion, cross its anterior surface—all which organs are then covered by the sterno-thyroid and sterno-hyoid muscles, various cellular lamellæ, the internal border of the sterno-mastoid, the aponeurotic layers of the neck, and the common integuments. Below, the recurrent nerve embraces it, while its concavity is separated from the lung only by the pleura or cellular tissue. It is in this short space that it gives off the vertebral, the internal mam-

mary, the thyroid, the transverse cervical, the ascending cervical, the deep cervical, and the superior intercostal. On the left side, the subclavian within the *scaleni* ascends almost vertically from the arch of the aorta to the border of the first rib, separating itself by degrees from the corresponding carotid. The pneumo-gastric nerve descends on its inner side; the recurrent nerve does not cross it behind, because it is not until after it has embraced the arch of the aorta, that it ascends upwards towards the trachea. The thoracic duct lies very near its posterior surface, and ordinarily bridges it above, before emptying itself into the left subclavian vein. This vein, which is separated from it by a very considerable space, crosses it at a great distance, while on the right side the artery is principally covered by the termination of the internal jugular.

[*Ligature on the Subclavian Artery, within the Scaleni Muscles, for Aneurism of the Subclavian.*—From a remark of Mr. Liston, (See his Surgical Lectures at the University College Hospital, London Lancet, No. XI., Vol. II., 1844, Dec. 7, p. 307, &c.) we are led to infer that he has recently *twice tied the subclavian on the inside of the scalenus* muscle for aneurism. He considers the ligature upon the subclavian *outside the scalenus*, for aneurisms a little beyond this point and which are still situated above the clavicle, as impracticable from want of room, owing to the crowding of the tumor in such cases upon the sterno-mastoideus muscle. (Ib. Ib.)

The *subclavian portion* of the brachial may be tied for aneurisms in the axillary portion; but this is often exceedingly difficult, from the size of the tumor and its extending so far upwards that you have, perhaps, to trench on the *scalenus* muscle, and thus wound the phrenic nerve. The advantage of pressing down the shoulder cannot be obtained with the same facility as in the subject; and on the left side, the vessel is a little more deeply seated than on the right. (Ib. ib., p. 307–308.)

In all these and other aneurisms, Mr. Liston says he has found the common *aneurism needle*, like that of Weiss, quite sufficient, as he has put a ligature with it on *all the vessels of the neck and all those of the extremities*, (Ib. ib., p. 308,) but considers those of Gibson, Mott, &c., complicated. (Ib. ib.) T.]

B.—Having become *horizontal*, the subclavian presents the same relations on both sides, and lies naked on the first rib; the lower attachment of the anterior *scalenus* muscle separates it from the vein, and this latter separates it from the sternal portion of the sterno-mastoid muscle; all the nerves of the brachial plexus are above and behind, so as to form, in prolonging themselves on the anterior surface of the posterior *scalenus* muscle, a kind of net-work, (grillage,) of which the artery constitutes the first radius, (rayon.)

C.—*Outside the scaleni muscles*, the subclavian artery corresponds to the supra-clavicular depression, and rests against the first intercostal space, the second rib, and the first bundle of the serratus magnus muscle. The vein which approaches it and covers it while descending a little towards the clavicle, receives there the sub-scapular vein, the external jugular, and sometimes

the acromial veins. It is accompanied on its superior border by the united branches of the last cervical pair of nerves, and of the first dorsal; then, a little farther on by the other branches of the brachial plexus, which soon pass behind; so that it is constantly found in the triangular space formed by the omo-hyoideus muscle upon the outside, the clavicle below, and the anterior scalenus muscle on the inside.

D. *Anomalies*.—I should remark that we sometimes find the vein with the artery between the scaleni muscles and the artery, occasionally taking the place of the vein, and that I have myself observed these two anomalies; when the little scalenus muscle exists, it may, as Robert remarks, while attaching itself upon the rib, separate the two inferior cervical nerves from the superior branches, incline them forward and push them towards the vessels; at other times it completely isolates the artery from all the nerves. The vein may be higher up than usual above the clavicle, or double, as Morgagni has seen it, and entirely conceal the artery, which latter is found moreover in certain cases, though rarely, surrounded on all sides by the brachial nerves; the presence of a small muscle attached by its two extremities upon the clavicle, the insertion of the sterno-hyoid muscle on the inside of the sterno-mastoid, the insertion upon the clavicle of a second root, or of the inferior widened border sent off, (*devié*) from the omo-hyoid muscle to the clavicle, are also anomalies which the surgeon ought to be aware of.

§ II.—*Indications*.

The subclavian artery being protected by the clavicle, and partly enclosed in the chest, or at least sheltered by the walls of this cavity, is but little exposed to external agents. Exempted also from those alternations of flexion and extension which the axillary and popliteal are obliged to assume, this artery is consequently disencumbered of a frequent occasional cause of spontaneous aneurisms. It is nevertheless, not invulnerable, and the diseases to which the other arteries are exposed have often affected this. M. Larrey, (*Clin. Chir.*, t. III., p. 142,) relates many examples of its wounds from swords, &c.; he has even seen two cases where they were followed by a varicose aneurism, (*Bulletin de la Faculté*, t. III., p. 27.) The subclavian artery however is tied not so much for the diseases that are proper to it, as for those of the axillary artery. Should, for example, an aneurismal tumor be developed in the supra-clavicular depression, though it may augment ever so little in volume, it will not be long before it will be impossible to place a ligature on the trunk which produces it, between this tumor and the heart: let an aneurism on the contrary in the hollow of the axilla, enlarge in size and increase upwards to such extent as to raise up the shoulder, and the ligature must be applied above the clavicle.

A. *Spontaneous Cure*.—Aneurisms which a ligature upon the subclavian may cure, may like others disappear spontaneously in certain cases, as has been shown by a case published by M. Ber-

nardin, (*Archiv. Gén. de Méd.*, t. VI., p. 511.) The method of Val-salva, refrigerants, &c., would also, without doubt, arrest some of them. M. Richarme cites in his thesis an example of a cure obtained in this manner. A case is also mentioned (*Jour. de Méd. et Chir. Pratique*, Septembre, 1830, t. I., p. 268.) of an *arterial hemorrhage*, from a sabre wound above the clavicle which was arrested by pledgets of lint, (bourdonnets,) dipped in *Binelli water* (eau de Binelli.) But as it is dangerous to let them take their course, and as the utility of these means is always problematical, the wisest plan is to operate as soon as possible.

B. *Method of Brasdor*.—The ancient method is not applicable in these cases. If it should not be practicable to employ the method of Anel, that of Brasdor is the only one that could be used in its stead. In that case, for a supra-clavicular aneurism it would not be upon the subclavian, that we would apply a ligature, but upon the axillary. Dupuytren is the first who attempted it upon living man. The patient it is true died at the expiration of nine days, on the 20th of July, 1829; but in the place of increasing in size as it was apprehended it would have done, the tumor had on the contrary, diminished in volume, and in a great measure lost its pulsations; finally, repeated hemorrhages and one from a supplementary branch, and which was at first attributed to the division of the principal artery, seem, much more than the operation itself, to have been the cause of death. The patient of M. Laugier, operated upon in the same way, lived a much longer time, and seems to have been the victim to accidents equally disconnected with the operation.

It must, however, be conceded that the axillary is one of those the least adapted to the method in question. The numerous branches that are given off from it constitute so many [collateral T.] channels, through which the blood will continue to flow, and which will prevent the aneurism from being consolidated, (se resoudre) unless they should have been previously obliterated by depositions of fibrine, or the progress of the disease. [The author doubtless means here, as one of the most frequent causes of such obliteration of the collaterals, the pressure of the increased size of the aneurismal sac itself on those collaterals. T.] The branches which the subclavian gives off within the scalenus, will constitute an obstacle not less formidable to the success of this mode of operating, so often as the disease shall have extended to that part. But as it is practicable to apply the ligature very near the sac; as it is possible that the internal concretions of the aneurism may have diminished, or even closed up the calibre of these arteries, and as the least resistance sometimes to the course of the blood suffices to produce coagulation in the sac, I am of opinion, that we ought to make trial again of what Dupuytren has done.

C. *Method of Anel*.—In following out the principles of Anel, the ligature upon the subclavian has been applied at three different points of its course, within the scaleni, between the scaleni and on the outer side of these muscles.

§ III.—*Operative Process.*

A. *Within the Scaleni.* I. *Process of Colles.*—M. Colles, (*Rev. Méd.*, 1834, t. I., p. 438.—*Gaz. Méd.*, 1834, p. 119,) M. Mott, (*Gaz. Méd. de Paris*, 1838, p. 600,) and M. Liston, are the only persons to my knowledge who have ventured to lay bare the subclavian artery between the trachea and the anterior scalenus muscle. A great difficulty was experienced in placing the ligature around the vessel, and it was supposed in one case that the pleura had been slightly wounded. Before the thread was tied, the respiration became laborious, and the patient complained of a feeling of compression near the heart. These symptoms became so alarming in the patient of M. Colles, that it was not thought advisable to tighten the ligature before the fourth day. The patient did very well up to the ninth day; at this epoch he again experienced strangulation and an acute pain in the cardiac region; delirium supervened and death took place nine hours after the commencement of these symptoms. On opening the body the aorta as well as the whole extent of the subclavian were found diseased. The case of M. Liston did well up to the ninth day, though at the time of the operation a ligature had been placed also, upon the corresponding primitive carotid, after an unsuccessful attempt at electro-puncture.

II. *Process of the Author.*—To arrive upon the arterial trunk, if we should not wish to follow the process of M. King, (*Thèse* No. 15, Paris, 1828,) it would be necessary to cut transversely upon the sound, the root of the sterno-mastoid muscle, to depress the internal jugular vein towards the trachea, the subclavian vein downwards and forwards upon the clavicle, and also to push back the carotid, the phrenic nerve and the pneumo-gastric. On the left, moreover, we should run the risk of wounding the thoracic duct (canal thoracique,) and should be obliged to penetrate much deeper; but it would not be impossible to place the ligature between the origin of the mammary and vertebral arteries, &c., and the heart, while on the right, the proximity of the brachio-cephalic trunk would render such an attempt one of the greatest danger.

III. In whatever manner performed, the ligature of the subclavian between the anterior scalenus muscle and the trachea, will be a laborious and formidable operation. As on the other hand we can scarcely conceive that it would suffice, when carried farther outward it should have offered no chance of success, I cannot see what could authorize its application.

B. *Between the Scaleni Muscles.*—Nor should it ever be performed between these two muscles, unless the state of the parts should absolutely forbid our applying the ligature outside of them. It is not that its execution is very difficult or that it might not succeed, but that the advantages it procures may be otherwise obtained, and that the section of the scalenus in itself an inconvenience, exposes us besides to the risk of wounding the internal jugu-

lar, or the subclavian vein itself, as well as the two nerves of respiration.

The ligature applied upon the axillary artery, in the hollow of the axilla, and according to the method of Brasdor, would offer more prospect of success, less danger, and infinitely fewer difficulties.

I. Process of Dupuytren.—This is the manner in which we would reach the trunk of the subclavian between the scaleni, in following the process of Dupuytren. We make at the base of the neck a transverse incision, which extends from the anterior border of the trapezius muscle, to the inner border of the sterno-mastoid, and which is prolonged even a short distance upon the outer side of this last muscle. After having satisfied ourselves that we have come down to the anterior scalenus, we insinuate between its posterior surface and the artery the extremity of a grooved sound, upon which we divide the muscle. By this section alone the artery is laid bare and completely isolated. The posterior scalenus serves as a guide to the eyed probe which bears the ligature.

C. Outside the Scaleni.—It is in the *omo-clavicular* triangle, or on the outside of the scaleni muscles, that the subclavian artery should be and has more especially been tied.

I. Process of Ramsden.—A transverse incision an inch and a half long, is first made above the clavicle; a second is then made two inches long, parallel to the outer border of the sterno-mastoid muscle, and which falls at a right angle upon the first; after having depressed the shoulder, M. Ramsden continues the dissection of the tissues in order to lay bare the border of the anterior scalenus; the artery is then easy to reach. Having isolated it with the nail he wished to pass a ligature around it; numerous difficulties presented themselves; it was found necessary to resort to a variety of movements; and it was not until after a very great number of trials and a considerable lapse of time that he succeeded in terminating this operation, which had been begun so auspiciously; the patient died on the sixth day.

II. Another Process.—M. T. Blizzard made an incision three inches long, parallel to the external jugular vein, at the lower part of the neck and towards the acromion. Post commencing his incision at the outer border of the sterno-mastoid, divided the tissues in the direction of a line slightly oblique in relation to the clavicle. M. Porter made a horizontal incision above the clavicle, then a vertical incision outside the sterno-mastoid muscle, and turned back the triangular flap thus formed. M. Dubled on the contrary proposes that the incision of the skin should be directed obliquely from above downwards and from without inwards, to make it terminate near the sterno-clavicular articulation. According to M. Hodgson the wound should be altogether transversal, and it is this last precept which unquestionably offers the greatest number of advantages. I do not think that the advice formerly given by a member of the Academy of Surgery, to include in the same ligature both the artery and the clavicle, should ever be followed. I have diffi-

culty also in comprehending what reasons could have induced M. Cruveilhier (*Etud. Anatom.*, t. II., p. 609) to say, that it would be advantageous to saw this bone in order to tie the subclavian with greater security.

III. *The Process to be followed.*—The patient should be placed upon his back, with his chest a little elevated; his head and neck should be turned to the sound side, while an assistant depresses the shoulder as much as the aneurism will permit, by raising (*en écartant*) the arm from the body.

A. *First Stage.*—The integuments are then divided in a transverse direction at an inch above the clavicle, and from the anterior surface of the sterno-mastoid muscle down to the trapezius; we divide in the same direction the cellular tissue, the fibres of the platysma myoides, and the external jugular itself, after having tied it above and below, if we cannot keep it out of the way by pushing it by means of a blunt *érigne*, either forwards (*en avant*) or backwards; we soon arrive at the aponeurosis which in its turn is also cut; then the fore-finger may feel the border of the scalenus immediately below and on the inside of the sterno-mastoid.

B. *Second Stage.*—After having torn apart or separated the cellular tissue, and the lamellæ, filaments, and ganglions, at the bottom of the wound, with the extremity of the sound or a good dissecting forceps, we apply the finger near the root of the scalenus to identify the *tubercle of the first rib*. This tubercle is a sure guide here, so much so, that if the pulp of the fore-finger without being taken off from it is carried a little outward and backwards, it almost constantly falls upon the vessel. Being once found the eye is no longer indispensable. The nail applied against its posterior and outer side serves as a director to the curved sound or to the needle we are using.

C. *Third Stage.*—By making the point of one of these instruments pass from before backward, and slightly from without inward, you soon get it under the artery which you raise up, at the same time that the finger placed between it and the first fasciculus (*faisceau*) of the brachial plexus, assists in supporting the vessel, and preventing its escape.

When the shoulder is not too much deformed, or too much raised up by the tumor, or when it is possible to depress it without inconvenience, any person possessed of tolerably accurate anatomical knowledge may succeed in applying this ligature with much less difficulty than is supposed.

IV. The section of the omo-hyoideus muscle proposed by some persons, and of the external border of the sterno-mastoid, as still practised by M. Mayo and M. Liston, is altogether useless. The assistance of the sound which should be preferred after the division of the aponeurosis, enables us to avoid the plexus formed by the confluence of the small veins of the shoulder and neck when they empty into the subclavian. To avoid also at the same time this latter vein nothing more is ever required than to pass the end of the director under it and near to the scalenus before directing the

point of the instrument backward with the view of hooking up the artery. Finally, inasmuch as the subclavian artery in the normal arrangement of the parts is constantly the first moveable cord that is felt by the finger on leaving the tubercle of the rib, and that the nerves moreover are distinguishable from it by their rounded form and their solidity, we cannot see what can lead to any mistake on the part of the operator.

D. *Method of Brasdor*.—M. Wardrop has tied the subclavian artery, by the method of Brasdor, for an aneurism of the brachio-cephalic trunk, in a patient whose corresponding carotid obliterated by the tumor soon after recovered its permeability. The success at first appeared complete, but after a certain time the aneurism began to enlarge again, and Madame Desmarest, who was the patient, died on the 13th of September, 1829. I will return to this case a little further on, and will confine myself to remarking, that it would be better in the event of our wishing to treat a lesion of the subclavian by this method, to place the ligature upon the artery immediately under than above the clavicle.

E. *Consequences of the Operation*.—The mortification of the limb which seems to be dreaded so much after the obliteration of the subclavian, is a circumstance that rarely occurs. In the patients of MM. Ramsden, Colles, Blizzard and Mayo, the phenomena noticed were suffocation, delirium, symptoms of cerebral affection, and implication of the heart or its envelope. After death there were found traces of pericarditis, diseased condition of the aorta or heart, and inflammation of the brain, but no gangrene. In some cases the circulation is re-established even with a remarkable rapidity; in the patient of M. Roux the pulsations reappeared in the radial and ulnar arteries two days after the operation. The blood is brought back into the axillary or the brachial, by the anastomoses of the internal mammary with the thoracic and the circumflex, and of the acromial and common scapular with the posterior cervical and the supra-scapular. If the ligature was placed within the scaleni beyond the vertebral and mammary arteries, the fluids could not arrive in the diseased side but by the communication of its vessels with those of the sound side.

F. *History and Appreciation*.—M. Ramsden, who performed his operation in November, 1809, appears to have been the first who actually tied the subclavian artery. Some time before him, M. A. Cooper had tried, but in vain, to seize this vascular trunk; he tied a nerve instead of it, and the patient soon died of hemorrhage. The same misfortune happened afterwards, under another form, to M. Lallemand, (Dubreuil, *Gaz. Méd. de Paris*, 1837, p. 563.) To relieve a hemorrhage of the axilla, this professor wished to tie the subclavian artery, but could not succeed; the patient died on the day after. The vein which was between the scaleni was at the distance of nine lines below the artery. In the month of April or May, 1810, a woman, aged about sixty years, was admitted into the Hotel Dieu of Paris, for an enormous aneurism in the axilla. Dupuytren believed that the operation of the ligature of the sub-

clavian could and ought to be performed ; Pelletan (*Dubreuil, Gaz. Méd. de Paris*, 1837, p. 563) was of an opposite opinion, and the patient died after a lapse of a few days without having been operated upon ; a sufficiently long time, however, after the attempts of MM. Cooper and Ramsden, to prevent our making any claim to priority in this matter.

A very aged and debilitated subject, operated upon in 1811, by M. W. Blizzard, also died on the fourth or fifth day. The same happened with the patient of M. Galtié in 1814. M. Th. Blizzard and M. Colles were not more fortunate in 1815. But complete success attended the operation of Post in 1817, and afterwards those of Dupuytren, MM. Liston, Bullen, Green, Gibbs, Key, Roux, Langenbeck, Mott, Porter, &c.

Moreover, the ligature upon the subclavian artery is one of those which most frequently jeopardize the life of the patient. In about sixty cases which have come to my knowledge, I find at least twenty-five cases of deaths, and as many of cure. Here is the list of the greater part of them :—

1. A. Cooper	-	Dead	-	-	S. Cooper, <i>Dict. de Ch.</i>
2. Ramsden	-	Id.	-	-	<i>Edin. Med. & Sur.</i> 1815, p. 1.
3. Colles	-	Id.	-	-	Boyer, 2. 245.
4. Th. Blizzard— Gang.-delir.	}	Id. 8th day	-	-	Hodgson, p. 133.
5. W. Blizzard					
6. Rigaud	-	Id.	-	-	<i>Thèse No. 106, Paris</i> , 1836.
7. Segond	-	Cured	-	-	<i>J. Hebdom.</i> , 1835, t. I., p. 33.
8. Gibbs	-	Id.	-	-	B. d. f. 8—83, <i>Arch.</i> , 8—595.
9. Monteith	-	Id.	-	-	<i>Lancet</i> , 28—266, t. I.
10. Ferguson	-	Cured	-	-	<i>Ed. Jour.</i> , 1831, <i>Arch.</i>
11. Liston	-	Id.	-	-	{ <i>Ed. Jour.</i> V., XVI., <i>Arch.</i> <i>Gén.</i> , t. XXVIII., p. 266.
12. Liston	-	Dead	-	-	
13. Galtié	-	Id.	-	-	<i>Ed. Jour.</i> , ib., 348.
14. Seutin	-	Id.	-	-	<i>Delp. Clin.</i> , t. I., p. 18.
15. Roux	-	Id. transf.	-	-	<i>Bull. Belg.</i> , Sept., 1834.
16. Montanini	-	Cured	-	-	<i>Thèse No. 218</i> , 1834.
17. Lallemand	-	Dead	-	-	<i>Gaz.</i> , 1837, 285.
18. Langenbeck	-	Cured	-	-	<i>Ib.</i> , 562.
19. Baker	-	Dead	-	-	<i>Lancet</i> , 1828, 1. 249.
20. Grossing or Crossing	}	Cured	-	-	<i>Ib.</i> 1829, 2. 210.
21. Mayo					
22. Bullen	-	Id.	-	-	<i>Arch.</i> , 2e sér., 1. 543—541.
23. Key	-	Id.	-	-	<i>Ibid</i> , 455,—546.
24. Green	-	Id.	-	-	<i>The Lancet.</i>
25. Buchanan, after amputation	}	Dead	-	-	<i>Ibid.</i>
26. Lallemand					
					<i>Ib.</i>
					{ <i>Trans. Med.</i> , 1835.
					{ <i>Arch. Gén. de Méd.</i> , 2. 9. t. VII., p. 474.

27. Travers	-	-	Dead	-	-	<i>Lond. Gaz.</i> , 1827, p. 333.
28. ———	-	-	Ib.	-	-	<i>Trans. Med. Ch.</i> , 1829, 314.
29. Arendt	-	-	Cured	-	-	<i>Med. G.</i> , 1827, 502.
30. B. Cooper	-	-	Dead	-	-	<i>Lanc.</i> , 1828, v. I., p. 448.
31. Post	-	-	Cured	-	-	<i>Med. Gaz.</i> , 9. 185.
32. Mott	-	-	Id.	-	-	{ <i>Arch. Gén.</i> , t. XXVII., p. 259.
33. Brodie	-	-	Dead	-	-	<i>Med. G.</i> , 1827, p. 504.
34. Porter	-	-	Cured	-	-	<i>Med. G.</i> , 7.
35. Nichols	-	-	Id.	-	-	<i>Med. G.</i> , 2—241.
36. Roux	-	-	Id.	-	-	<i>Boyer</i> , 2—234.
37. Dupuytren	-	-	Id.	-	-	<i>Lec.</i> , 4—524.
38. Colles	-	-	Dead 11th day	-	-	<i>Boyer</i> , 2—246.
39. Post	-	-	Cured	-	-	<i>Boyer</i> , 2—246.
40. Dupuytren	-	-	Id.	-	-	<i>Rev.</i> , 1821, 9—221.
41. Mayo	-	-	Dead	-	-	{ <i>Med. Chir.</i> , 12, p. 12.— <i>Arch. G.</i> , 2e sér., t. I., p. 546.
42. Roux	-	-	Cured	-	-	<i>Bib.</i> , 1825, 8—156.
43. Brodie	-	-	Dead	-	-	<i>Med. Gaz.</i> , 9—430.
44. Mott	-	-	Cured	-	-	<i>Med. G.</i> , t. VIII., p. 106.
45. Auchingloss	-	-	Dead	-	-	{ <i>Ed. Med.</i> , <i>April</i> , 1836, p. 324.
46. Alison	-	-	Id.	-	-	<i>Arch. G.</i> , 2e s. t. VII. p. 388.
47. Montault	-	-	Id.	-	-	<i>Gaz. Med.</i> , 1836, p. 585.
48. Baroni	-	-	Cured	-	-	<i>Ib.</i> 1835, p. 695.
49. Liston	-	-	Id.	-	-	<i>Ib.</i> 1823, p. 600.
50. Fearn	-	-	Id.	-	-	<i>Gaz. Med.</i> , 1838, p. 601.

CHAPTER III.

ARTERIES OF THE HEAD.

There is scarcely a branch of any importance, whether in the face or the cranium, which may not be wounded by external agents, or become the seat of one of these spontaneous aneurisms which are qualified with the name of mixed or true.

ARTICLE I.—ARTERIES OF THE EXTERIOR.

Two aneurisms, one on the head and the other on the jaw, were not ascertained till after death, owing, says Barbette, (*Chirurgie*, ch. 16, 2e part, liv. I., p. 218,) to their being without any pulsations during life. Paletta cites one example, and Scarpa (*Obs. sur l'Aneurisme, etc.*) two, of aneurisms of the temporal artery.

[False *circumscribed aneurisms* are not an unfrequent occurrence some few weeks after opening the temporal artery in practice. I have seen two. Each formed a perfect sphere of twice or thrice the diameter of an ordinary pea, and nearly as perfectly spherical in shape. The covering of the sac was so thin as to be purple in color from the blood when seen through it. The pulsations were distinct to the naked eye at some distance. The artery will appear to have healed soon after the operation, and some weeks may elapse before the aneurism makes its appearance. In one of the above cases it burst repeatedly, and was followed each time by considerable hemorrhage, but this did not disturb me, as the case, one of acute obstinate cephalgia required farther depletion. It was finally healed up by well directed pressure, with graduated compresses and a bandage bound tight around the head. In the other case a much older person, being 55, and one of extraordinary sanguineous temperament and florid health, compression in the same way was equally effectual. I am of opinion that the aneurism in these cases was owing to the artery not being as it should be *severed* completely through, not partially divided only, as improperly recommended in arteriotomy of this trunk. I have performed the operation a great many times and never before met with an aneurism here, because my practice is to divide the artery entirely. It is a mistake to suppose it will not then give blood enough. There is one surgeon in New York who is very fond of this operation; I think he has performed it at least a hundred times, and no aneurism has, I think, followed in any instance. T.]

M. Green (*The Lancet*, 1828, t. II., p. 381; et Fletcher, *Thèse* No. 267, Paris, 1836) has made known a fourth. Klaving mentions one which occupied the left posterior auricular in a young man of twenty-five years, and M. Renzi (*Velpeau, Med. Oper.*, trad. Ital., p. 182) relates a case analagous to that of M. Nanulla. Dehaen has seen the same thing on the dorsal artery of the nose. M. Godichon has described an aneurismal pedunculated tumor on the forehead larger than the thumb; he has noticed another in front of the right parietal protuberance.

We find in the *Actes* of Leipzig, the case of an aneurism of the frontal artery, and I have also met with one example of it. In a similar case, M. Brodie (*The Lancet*, 1829, vol. II., p. 259) operated by the ancient method with success. MM. Gasté, Mérat, and Stone, (*Journal des Progrès*, 2e série, t. II., p. 215,) also speak of aneurisms in the temple. M. Gama has cured one which existed near the commissure of the lips. M. Bégin cites one which occupied the middle meningeal, and which caused the death of the patient, after having perforated the temporal fossa. M. Krimer (*Jour. des Prog.*, t. X., p. 237) relates a similar fact, if it is not the same. Pelletan mentions an aneurismal, or erectile tumor, in the eyelid, in a young boy; another on the conjunctiva of a second patient, and in a third a similar disease in the upper part of the forehead. He has also seen, in two different cases, almost all the branches of the occipital, or temporal, and even of the external

carotid, dilated and hypertrophied, as if they were varicose. The same thing took place in a patient of M. McLachlan, (*Encyclog. Med.*, 1836, p. 131.) A patient, of whom M. Kuhl speaks, (*Glasgow Med. Jour.*, 1828,) had the cranium covered (criblé) with aneurisms. M. de Noter, (*Bullet. de la Soc. de Gand*, 1836, p. 192,) relating a similar fact, gives a figure which shows that his patient had all the external arteries of the cranium transformed into enormous varices, (*Bull. de la Soc. de Gand*, 1836, p. 192, et *Encycloped. Med.*, 1836, p. 131.) The palatine artery itself is not exempt from these aneurismal dilations, as appears by an observation of M. Delabarre.

ARTICLE II.

As to the *arteries of the interior* of the cranium, they may, though less frequently, be the seat of lesions of the same kind as those of the exterior. Examples of varicose aneurisms, or of aneurism by anastomosis of the eyelids, or of the orbit, have been published by MM. Wardrop, Travers, and Arendt. M. A. Cooper has noticed a small aneurismal sac on the central artery of the retina. MM. Serre, Lebert, and Bright (*The Lancet*, 1839, vol. II., p. 727) have described another as large as a walnut, which was seated in the basilar artery, and M. Hodgson describes a case in which a small sac, formed by the anterior cerebral artery, was completely filled with a solid clot of blood, which did not enter into the cavity of the vessel. Other examples of the same character have been collected by M. Nebel, (*Dissertatio Inaugur.*, &c., Heidelb., 1834,) who also gives the figure of an aneurism, developed upon the sella turcica, at the expense of the artery of the corpus callosum.

[*Aneurism of the Basillary Artery.*]

Dr. G. Pfeufer (*Mém. de la Soc. J. R. des Méd. de Vienne*; also, *Archives Gén. de Méd.*, Paris, Juillet, 1844, p. 360, et seq.) relates a case which confirms the above facts that the *basillary artery*, at the base of the brain, may also have its aneurisms, but which necessarily are as far removed as it is possible to conceive anything in the human organization to be, beyond the reach of surgical aid, or pathological diagnosis. The patient was a man aged forty-seven, of feeble constitution, and latterly subject to gout, finally, to asthma, with serous expectoration, distressing palpitations of the heart, together with which there ultimately supervened œdema of the legs, scanty urine, intermittent pulse, numbness of the upper extremities, a bruit de freuissement and sifflement at the base of the heart, corresponding to the impulsion of the organ, ending finally in asphyxia and death. A severe antiphlogistic course had, in the beginning, seemed of benefit.

On the post mortem there were found extensive adhesions of the costal pleura, hepatization of the left lower lobe of the lung, effusion in the two pleuras and pericardium, the heart double its natural size,

the walls thickened, right ventricle and auricle both dilated, the latter to the size of a goose-egg, the tricuspid valve defective from the dilation of the corresponding orifice, and the mitral valve normal. The semi-lunar valves of the aorta were completely ossified, and the ventricles and auricles full of coagulated blood. [See case of *Basilar Aneurism* under Dr. Mott's Remarks, *infra*. T.]

ARTICLE III.—INDICATIONS.

Of two things one must happen : nothing, for example, can lead us to suspect the existence of the aneurism when it is shut up within the cranium, and the aid of surgery, therefore, cannot be appealed to ; or the disease is seen externally, and in that case we must proceed as for aneurisms of the limbs. The patient of M. Krimer died of a frightful hemorrhage, because mistaking his aneurism for encysted tumor, it was extirpated. That of M. Stone got well without assistance. Percy mentions that he saw Lombard, who tells it himself, mistake an aneurism of the occipital artery for an abscess, and compelled to come to the ligature. The simple operation succeeded with M. Syme (*The Lancet*, 1829, vol. I., p. 598) in the case of an aneurism of the auriculo-mastoidean. M. Green, who operated for a varicose aneurism, tied the artery below and above the tumor. M. Carswell has since reported the history of another varicose aneurism in the temple, caused by scarification in this region. After having tied the arterial trunk below, it was found necessary to make the division of the branches above. M. Larrey (*Clin. Chir.*, t. I., p. 189) himself succeeded with cauterization, in the case of a wound of the middle meningeal artery.

We thus see that all kinds of aneurisms, and all kinds of treatment that are practised for those diseases, apply to those of the cranium as to those of other regions. Also, the great number of anastomoses makes it requisite, in these cases, even more so than in the foot that we should tie or compress both below and above. Aneurisms which are the consequence of temporal arteriotomy, are also much more common in England than in France. M. A. Cooper (*Lect.*, &c., vol. II.) operated for one of them by the ancient method successfully. That which Burns (*Surg. Anat.*, p. 342) mentions, was a varicose aneurism. M. Bush (*The Lancet*, 1828, vol. II., p. 413–456) speaks of three cases where he was obliged to extirpate the tumor ; and M. Desruelles has described this disease in detail. If compression should not answer, the opening of the sac should be attempted. M. Cisset did it once with success for the occipital artery ; in other cases the ligature of the carotid itself is preferred to that of the artery, which is the seat of the disease. [See our note above. With the temporal, we are of opinion that compression, properly applied to the tumor, will always be sufficient. T.]

ARTICLE IV.—OPERATIVE PROCESS.

There is hardly any rule to be given here in relation to the operation, except for the trunk of the facial, occipital, and temporal, that is, in those cases where we do not act upon the seat of the lesion itself.

§ I.—*Temporal Artery.*

We easily find the temporal at three lines, in front of the ear, a little above, and on a line with the zygomatic arch; an incision an inch long is sufficient to arrive at it in the deep lamellæ of the cellular tissue by which it is enveloped. [See note above. T.]

The aneurisms of the cranium, moreover, having no fixed position, it is necessary, in order to treat them by the method of Anel, that we should leave ourselves to be guided much more by the pulsations of the artery, than by any anatomical relations laid down in advance. Another indication to be recollected is this, that whether we follow the ancient method, or operate without opening the tumor, the ligature should be placed very near the aneurism, both above and below, and on all the branches which go into or come out from it.

§ II.—*Occipital Artery.*

The occipital artery is to be sought for in the neck. But it is so much concealed in this part, that be the case what it may, we should make a direct application of the ligature upon the artery, or do it at the opening of the vessel, seizing it at the point where it is wounded rather than to attempt the method of Anel.

§ III.—*Facial Artery.*

The facial at its arrival upon the lower maxilla, would not be more difficult to cut down to, than the temporal. By cautiously dividing the skin on the edge of this bone, and in a horizontal direction, from the anterior border of the masseter to the triangular muscle of the lips, we would be sure of coming down upon it immediately. We may also reach it, by dividing the parts which cover it, to the extent of an inch, or an inch and a half, obliquely from above downwards, and from before backwards, quite close to the masseter muscle; its satellite vein is the only organ which it is important to avoid, and even that might be wounded or included in the ligature without any serious inconveniences resulting from it. Like the temporal the facial artery ought also in general to be tied both above and below the sac, or at its two ends, in order to give the operation every possible chance of success. Siebold says, he has tied it successfully for an intermittent hemorrhage of the gums.

CHAPTER IV.

ARTERIES OF THE NECK.

The arteries which we may be required to tie in the neck are the maxillary, lingual, pharyngeal, thyroid, vertebral, carotid, and trunk of the *arteria innominata*.

ARTICLE I.—EXTERNAL MAXILLARY ARTERY.

To lay bare the maxillary artery in the neck, we should make an incision two inches long, parallel to the inner margin of the sterno-mastoid, and the middle part of which should correspond to the great cornu of the thyroid cartilage. After having divided the skin, the *platisma myoides*, and the cervical aponeurosis, then pushed aside the muscles and brought the carotid itself into view, it is necessary to tear open by means of the grooved sound, the sheath of this vessel upon its anterior side, up to the *os hyoides*. Here we find the origin of the facial artery, which runs obliquely inward and upward to reach the sub-maxillary gland, and the lower border of the jaw.

Another process also, which I described in 1825, (*Anat. Chir.*, t. I., p. 179,) consists in dividing the tissues from the great horn of the *os hyoides* to the border of the sterno-mastoid muscle; in order to seek for the artery between the sub-maxillary gland and the digastric muscle.

ART. II.—LINGUAL ARTERY.

Many practitioners have felt the necessity of obliterating the lingual artery, and some of them have even pointed out the mode of doing it. For in addition to the fact that the wounds of this artery would become too dangerous, if in order to arrest their hemorrhage, we were forced to tie the carotid artery, they might also have this inconvenience that the blood would probably continue to flow by the upper end, by means of the anastomoses of the face, and perhaps, also, from the lower end by the return of the circulation through the internal and external carotids.

On the other hand, the lingual artery may be the seat of aneurisms. Colomb, (*Obs. de Méd. et de Chir.*, p. 451,) relates an example of it which he cured by opening into the sac, and by the ligature. But it is for the purpose more especially of arresting the progress of certain erectile, fungous and cancerous tumors of the tongue, that after the example of Bécclard this operation has been proposed, which would also be a valuable resource if it could be performed before carrying the bistoury to the tongue itself, when we are obliged to amputate a certain portion of that organ.

Bécclard appears to have been the first who gave a correct de-

scription of the process by which the lingual artery may be reached with precision ; but this process has never been published.

§ I.

The process which I have pointed out above for the maxillary artery equally applies to the lingual, which is a little deeper, and at first courses horizontally, before taking a vertical direction, between the os hyoides and the muscles of the tongue.

§ II.—*Process of the Author.*

The following is the one which I have elsewhere recommended, (*Anat. Chirurg.*, t. I., p. 180, 1825 ; et t. I., p. 424, 1833.) We make an incision in the supra-hyoidean region, which should approach a little more to a horizontal than to a vertical line, in order that its anterior extremity may extend towards the chin. Penetrating thus at some lines under the submaxillary gland, we may seize the artery of the tongue behind the hyo-glossal muscle by pushing aside the nerve that crosses it, or what is as well, under this muscle itself, by dividing those of its fibres which form a thin layer upon the vessel. It must also be observed, that the facial artery passes above and on the inside of the submaxillary gland, while the lingual lies lower down.

§ III.—*Process of M. Blandin.*

(*Anat. Topog.*, p. 194.) A small incision parallel to the os hyoides which is easily felt, enables M. Blandin to cut in this manner, through the skin and plastima myoides, and then to raise the digastric and stylo-hyoid muscles. The hyo-glossus muscle would be involved (interestée.—See a few lines above,) and the artery being laid bare could easily be seized by means of a grooved sound. We must not go too far from the great horn of the os hyoides for fear of wounding the hypo-glossal nerve.

This process which scarcely differs from that which precedes it, is neither better apparently nor worse. Both permit of our reaching the artery, but the operation is not easy either with the one or the other.

§ IV.

M. Mirault, (*Mém. de l'Acad. de Méd.*, t. IV., p. 35,) also, who could not succeed in tying the lingual artery by the ordinary processes, endeavoured to devise a new one. Having carefully studied the anomalies of this artery, on thirty-eight dead bodies, he saw that in twenty-one it originated on a level with the os hyoides ; that in fourteen its root was found from one to eight lines above, and in three only at three lines below ; from whence he concludes, as I had also myself ascertained, that it is above this bone that we must seek for the lingual artery.

In place of dividing the parts obliquely from below upwards and from behind forwards, as if to cross the submaxillary gland, M. Mirault proceeds in the following manner:—The patient having his head thrown backwards and his chin turned towards the sound side, the surgeon, grasping the upper region of the neck with the thumb and fore-finger of the left hand, divides the tissues in the direction of a line which extends from the upper border and anterior part of the great horn of the os hyoides, to the anterior margin of the sterno-mastoid muscle, on a level with or a little above the angle of the jaw. After having thus divided the skin, the sub-cutaneous fascia and the platysma myoides, he reaches the external jugular vein which he pushes aside or ties, and divides in order to cut immediately through the *cervical fascia*, and to lay bare the submaxillary gland, which he detaches and gently turns back from below upwards. After having divided the deep layer of the aponeurosis which then presents itself, we come to the pharyngeal and lingual veins, which it may be advisable to tie and to cut in order to lay bare the great hypo-glossal nerve. The artery is found between this nerve and the lower border of the stylo-hyoid muscle near the great horn of the os hyoides. Nothing more then remains to be done but to isolate the vessel by means of a grooved sound, or by a curved needle, and to surround it with a ligature.

§ V.

M. Flaubert, who appears to have once tied the lingual artery, in 1835, recounts the kind of difficulties that he met with ; so that the rules for the operative process may be established now upon trials and facts furnished from the dead body as well as from living man. It is impossible at the present time to say what might be obtained from this ligature in operations to be performed upon the tongue or in organic diseases of this body. M. Flaubert, (Voranger, *Thèse* No. 85, Paris, 1836,) who makes his incision from the point of union of the small and great horn of the os hyoides, outwardly and upwards, towards the angle of the jaw, found the operation very simple ; it was in order to remove with less danger a tumor of the tongue, and I have already said, that M. Mirault, not being able to find the artery, had in a case of this kind tied the tongue itself.

I am not aware that these processes which upon the dead body have not appeared to me perceptibly more simple than my own, would render the operation much more easy on living man. It is evident, also, that if it was a case of recent wound with hemorrhage, it would be necessary to dilate the wound and to seek for the artery in the midst of the wounded tissues. Colomb, also, having operated by the ancient method, found himself under the necessity of being guided much more by the seat of the tumor than by any rules previously traced out.

ARTICLE III.—THYROID ARTERIES.

The thyroid arteries have already been tied by numerous practitioners, and especially by MM. Graefe, Hedenus, (*Journal de Graefe et Walther*, t. II., p. 242, et *Gaz. Méd.*, p. 169,) Coates, (*Medico-Chirurgical Trans.*, vol. X., p. 318,) and Langenbeck, (*Bulletin de Férussac*, t. X., p. 363,) to allow of the extirpation of the thyroid body or to cause its atrophy, in cases of scirrhus degeneration or goitre. M. Walther, (*Soc. de Méd. de Marseille, Compte Rendu*, 1818, p. 34; *Journal de Graefe et W.*, t. XIII., p. 203,) M. Earle, (*Bull. de Férussac*, t. X., p. 289,) M. Blizzard, (*Ibid.*, 288,) M. Brodie, (S. Cooper, trad., p. 244,) and Carlisle, (*Gaz. Méd. de Paris*, 1833, p. 657,) have also had recourse to it, to effect this last mentioned purpose. It is also in order to avoid the danger of coming in contact with the thyroid arteries that the trunk of the carotid itself has sometimes been tied; as, for example, in the case of M. Boileau. This ligature would probably have prevented suffocation in the patient mentioned by Heime, and in whom the thyroid artery had been opened.

§ I.—*The Superior Thyroid.*

The incision is made in the same manner as far as the external maxillary; as soon as the sterno-mastoid muscle is pushed aside from the larynx, we see in the *omo-hyoid* space the jugular vein and the primitive carotid. After having torn apart the fibro-cellular lamellæ which cover and unite these vessels, the thyroid artery, though deeply situated, presents itself naked between them and the corresponding lobe of the thyroid gland. Some small veins occasionally conceal it, but it is always easy to isolate it with the grooved sound, and the more so as we approach nearer to the trunk that gives origin to it.

§ II.—*The Inferior Thyroid.*

The incision should be made here in the same manner as for the ligature upon the carotid at the lower part of the neck. The thyroid arising from the subclavian, passes behind the internal jugular, the pneumo-gastric nerve, and the carotid artery itself; in order afterwards to ascend obliquely upon the posterior surface of the corresponding lobe of the thyroid gland; the upper portion of the *omo-hyoid* muscle ordinarily conceals it. It is necessary to divide or to depress this muscle in order to seize the artery behind it, between the trachea or œsophagus and the trunk of the carotid, taking care in the meantime to avoid the recurrent nerve and the descending branch of the great hypo-glossal nerve. We find it between the longus colli muscles and the anterior scalenus, outside the jugular, and accompanied by the phrenic nerve; we might there-

fore cut down to it by means of the process which M. Sédillot recommends for the ligature upon the carotid.

ARTICLE IV.—THE VERTEBRAL ARTERY.

The vertebral artery concealed in the canal of the transverse processes of the cervical vertebræ, seems up to the present time to have been placed out of the reach of all surgical solicitude.

§ I.—*Anatomy.*

Nevertheless, if we remark with M. Ippolito, that this artery, as I myself have also ascertained, in the place of always passing into its canal by the foramen of the sixth or seventh cervical vertebra, frequently does not enter it until it has reached the fifth, and quite often even that of the fourth, sometimes also that of the second or first, we may understand how external violence of every kind may affect it with almost as much facility as the carotid. Admitting, even, that the vertebral artery runs through the entire canal formed by the succession of the transverse processes, it is easy to see that sharp-pointed or cutting instruments and fractures in the cervical region are also of a nature calculated to wound it. At the point where it turns round upon the postero-external surface of the atlas to enter the cranium by the occipital foramen, the loops that it forms exposes it in a special manner to wounds and aneurisms.

§ II.—*Indications.*

Spontaneous aneurisms of the basilar artery, which I have spoken of above, are additional motives for the surgeon to interest himself in the operations which it might be possible to perform upon the vertebral artery. Should I not add that the trunk of the carotid has been tied by mistake in a case where the vertebral artery alone had been wounded? Fabricius already, in 1746, relates the case of an individual who perished from a wound of this artery between the atlas and the occipital.

A man twenty-eight years of age was wounded below the left angle of the lower jaw by a sharp-pointed instrument. A false consecutive aneurism resulted from it, having its seat under the mastoid process. The professors of the hospital of Naples, consulting together, decided that recourse should be had to a ligature upon the primitive carotid artery, which was performed on the 18th of July, 1829, by Professor Chiari, (*Archivi di Chirurg. e Med.*, an. 2, No. 19.) The patient died on the ninth day, and the autopsy showed that the aneurism occupied the vertebral artery, between the transverse processes of the two first cervical vertebræ!

M. Ramaglia (*Filiatre Sebezzio*, ann. 3, fasc. 2) relates a fact somewhat analogous. A man, aged thirty-nine years, received a wound from a sharp-pointed and cutting instrument under the left

ear; the aneurism which resulted from it left the surgeons in doubt which was the wounded artery. M. Rispoli proposed to tie the vertebral artery, but the other professors were opposed to it; it was decided to obliterate the carotid. Seeing that the strangulation of this last did not arrest the pulsations in the tumor, the operator withdrew the ligature; various symptoms supervened, which, after a certain time, caused the death of the patient. The examination of the dead body here also showed that the aneurism originated from the vertebral artery. These observations having been communicated to the academy of Naples, MM. Castelacci and Grillo (*Rev. Méd.*, 1836, t. III., p. 399) were induced to undertake a series of researches, the result of which has not yet been published.

§ III.—*Operative Process.*

Being a witness to the facts, M. N. Ippolito (*Sulla Ligatura dell' Arteria Vertebrale*, 1834,) has examined in what manner the vertebral artery could be cut down to, and surrounded with a ligature.

A.—The *process* which M. Ippolito determines upon, is as follows: The patient should be laid horizontally, with his head a little turned towards the sound side. The surgeon, placed on the opposite side, makes an incision two inches long upon the external border of the sterno-mastoid muscle, and thus penetrates gradually down to the side of the anterior scalenus muscle. Afterwards, making use of the sound, he gently tears away the cellular tissue, finds the artery, separates it from the vein, and surrounds it with a ligature, by passing around it from without inwards.

I was, perhaps, the first (*Anat. Chir.*, t. I., 1835,) to point out the practicability and the manner of cutting down upon the vertebral artery. In 1833, I felt myself justified in recommending an incision which should pass between the two roots of the sternocleido-mastoid muscle; that is, by the process which M. Sédillot recommends for the ligature upon the primitive carotid.

B. *The Process that should be Adopted.*—At the present day, it would be easy to arrive at the vertebral artery by taking for our guide the carotid tubercle, pointed out by M. Chassaignac. Making part of the anterior surface of the transverse process of the sixth cervical vertebra, this tubercle, which is generally felt without any great difficulty through the skin, is found at some lines within, or at some lines above the trunk of the vertebral artery; but as the width of the sterno-mastoid muscle is extremely variable, and that also of the upper notch of the sternum, I do not think that the incision of the integuments should always be made upon the same part of the neck. Whether, after the manner of M. Ippolito, we make it on the outside, or find it more convenient to carry it upon the inside, or prefer that it should fall between the two roots of the sternomastoid muscle, it would nevertheless be necessary to divide the tissues successively and with caution until the vertebral tubercle could be felt with the finger. Then the grooved sound being substi-

tuted for the bistoury, will place it in our power, after dividing the cellular tissue a little below, and with the finger pushing back the jugular vein and the carotid artery to the inside, to isolate the vertebral artery without any very great difficulty. A curved needle, sufficiently short, and made after the pattern of that of Deschamps, would render the passage of the ligature less painful than if we depended upon the flexible probe.

This operation never having been performed upon living man, it is unnecessary to describe it more at length in this place. Now that surgeons are aware of its practicability, and that they know the cases that may require it, we must wait until experience has put it in our power to appreciate its difficulties.

ARTICLE V.—THE PHARYNGEAL ARTERY.

If the operation of the ligature upon the carotid artery has been so frequently performed, this has happened as much so, perhaps, because, in a great number of cases the arterial branch actually wounded did not seem accessible, as because of the diseases proper to the common carotid itself. A hemorrhage from the facial, laryngeal, occipital, or lingual artery, and from the different branches of the external or internal maxillary, have, without doubt, been often treated by a ligature upon the primitive carotid. The danger, in fact, from wounds of any of these arteries is sufficiently great to justify important expedients, since a patient of whom Saurerotte speaks, and who had a wound of the laryngeal artery, died in consequence of being suffocated from blood; that a lesion of the thyroid artery produced the same result in a patient mentioned by Heime; and that the same thing would have happened from a hemorrhage from the gums, alveoli, and vault of the palate, if Siebold had not taken the resolution to tie the facial artery, or that M. Duval and M. Delabarre, in a similar case, had not found means of arresting the blood by compression.

The inferior pharyngeal artery, besides being quite small, is so deeply situated that we have scarcely anything to fear from its wounds. Since in the patient of M. Mayo, who had a hemorrhage from the throat—in another of M. Syme, that lost blood from the mouth and ear—and in those of M. Luke and M. Duffin and some others—the wound, in all of them, was situated upon the branches rather than upon the trunk of the carotid—is it not evident that the ligature upon the wounded branch would have been more efficacious, and especially less dangerous, than that on the common carotid, which in reality was the artery tied. The misfortune here is, that it is sometimes difficult to determine the seat of the arterial division. Admitting, however, that we should be enabled to ascertain it, and the thing appears to me practicable in the greatest number of cases, I would be disposed to lay down this law: In hemorrhages from the neck, mouth, throat, ear, or cranium, *we*

should do all in our power to reach the arterial branch that is wounded, rather than tie the carotid artery itself.

As to the inferior pharyngeal, properly so called, we could reach it by cutting down as we do to lay bare the upper extremity of the common carotid. By separating, with the extremity of a sound, the lamellæ which unite the internal and external carotid, we should find its trunk lying between these branches, in such manner as to enable us then to pass a ligature around it without difficulty. We should know if it was this artery which kept up the hemorrhage, by taking the precaution, before finally tying it, of alternately compressing it with the finger and then leaving it free. The search for the pharyngeal, moreover, would not expose us to any inconvenience, since the same incision would suffice, should it become necessary for the ligature upon either carotid, for the lingual artery, or for the external maxillary or superior thyroid artery—all which should be seized hold of in succession, in order to be certain which is the one which is really divided.

ARTICLE VI.—THE SECONDARY CAROTID ARTERIES.

It may readily be supposed that surgeons formerly must have found it more convenient and secure to tie the common carotid for all the arterial diseases of the cranium or head, than to endeavour in certain cases to tie the secondary carotids or their branches; but that is no longer admissible at the present time. There is a class of diseases especially which in this respect seems imperiously to demand a modification in surgical practice; I refer particularly to varicose aneurisms, aneurisms by anastomosis and erectile tumors. When in fact we have tied the common carotid for one of these diseases, the blood of the opposite side, returning by the internal carotid, re-enters from below upwards into the external carotid, at the same time that it returns into this latter by its own appropriate anastomoses. Thus Pelletan, Dupuytren, MM. Wardrop, Kuhl, and De Noter, operating for varicose aneurisms, failed by tying the [common] carotid only, and it was remarked that the erectile tumors of certain regions of the head, yielded much more readily to this ligature than others did. These tumors, when having their seat in the temporal region have resisted the ligature upon the (common) carotid in the hands of MM. Willaume, Mussey, Roux, and many others, while the same operation has generally succeeded with similar tumors developed in the orbit or in the substance of the eyelids. The ligature upon the external carotid would put a period to this difficulty for all tumors of the face and the exterior of the cranium, and it would be necessary to tie the internal carotid for the aneurisms or arterial diseases of the orbit.

§ I.

M. Mayo having anticipated this indication, asks if it would not

be better for hemorrhages or aneurisms of the head, to tie separately the external and internal carotid, in place of acting upon the common carotid. M. H. Bérard, (*Dict. de Méd.*, 2e edit., t. VI., p. 414,) who has demonstrated the inutility of thus tying the two carotids for the diseases of one only, proposes to tie at first the primitive carotid, then to place another ligature upon one of the two secondary carotids, it is immaterial which, under the expectation that it would be difficult for the circulation to re-establish itself in the external carotid artery, if it is that which has been tied, by means of the anastomoses of the internal carotid, and difficult also in the contrary case in this last by means of the external carotid. The reasoning of M. Bérard in this case does not appear to me to be well founded. I have not found that it was difficult as this author believes it is, to distinguish the two secondary carotids from one another, and it appears to me altogether rational when we wish to tie only one of them, to tie that which is diseased in preference to that which is not so.

§ II.

This operation I have performed in still another manner. A young man aged sixteen had at the lower part of the temple a tumor accompanied with pulsations. This youth who was seen by a great number of surgeons of the capital, and exhibited by me to the Royal Academy of Medicine, appeared to be affected with an aneurism, or an erectile tumor of the pterygo-temporal fossa. The bruit of the vessels, (bruissement vasculaire,) the visible heaving up and pulsation of the tumor, and the manner in which it had been developed, united in establishing this diagnosis. Having laid bare the carotid upon the side of the os hyoides, in the omo-hyoid triangle, I isolated its bifurcation, and was only incommoded in that part by some lymphatic ganglions. After having tied the common trunk of this artery, I proceeded to the ligature upon its internal branch, which as it always is, was within and a little behind.

The tumor which immediately ceased to pulsate, rapidly diminished in volume. Repeated hemorrhages, soon followed by a complete hemiplegia, caused the death of the patient upon the sixteenth day. The blood came from the external carotid and escaped by the upper end of the common carotid. The tumor also was hard, and rather fibrous than erectile. Placed over (supportée by) the external maxillary artery which was double its natural size, and which passed above the external pterygoid muscle, in place of traversing the space which separates the muscle from the internal pterygoid, the tumor was raised up in such manner as to present the characters of a true aneurism. Perhaps also it had been contracted and indurated at this point after the operation, and in consequence of the exhaustion of the patient. The common carotid having been closed I had hoped to place an impediment (digue) against the return of blood by tying the internal carotid. I did not wish to tie both the secondary carotids, for fear of seeing the circulation kept

up in the common carotid up to its bifurcation. Does the result prove that I was wrong?

§ III.

For the *operative process*, we should proceed in every particular as if it was for the primitive carotid artery, with this difference however that the incision should be prolonged upward to above the level of the angle of the jaw, and that it would be important to turn aside (incliner) and forcibly raise up the chin towards the sound side. We commence then by laying bare the common carotid. Ascending afterwards with caution we soon arrive upon the bifurcation of this trunk and the root of its two branches. The lymphatic ganglions, veins, and nervous filaments must be carefully pushed aside; the two carotids being laid bare we may be sure that the external is most superficial and nearest to the larynx. We recognise it moreover by the branches of the third order which originate from it to go to the face and the rest of the neck. It would be important also to place the ligature above and below the whole groupe of arteries (*tout le bouquet artériel*) which the external carotid gives off near its origin, and to take measures against the dangers of the collateral circulation.

ARTICLE VII.—THE PRIMITIVE CAROTID.

§ I.—*Anatomy.*

A. On leaving the chest the carotid artery soon places itself on the side of the passages of respiration and deglutition, where it continues up to the moment of its bifurcation which generally takes place opposite the thyro-hyoid space. The internal jugular vein lies upon its outer surface and conceals even a part of its anterior surface during life. On the inside, elastic and resistant cellular lamellæ, branches of the recurrent nerve and inferior thyroid artery, separate it from the larynx, trachea and œsophagus. The cardiac nerves of the pneumo-gastric, and the internal filaments of the great sympathetic, cross more or less obliquely its posterior surface, along the entire length of the outer border of which moreover run the trisplanchnic and the pneumo-gastric themselves. A yellowish solid sheath, difficult to be torn, unites it to the vein and nervous cords, and to the descending branch of the great hypoglossal which usually follows its antero-external portion. Resting moreover against the front portions of the cervical vertebræ, and covered near its origin by the sterno-mastoid muscle, which soon separates from it so far as to leave it free upon its whole inner margin, covered also by the outer border of the sterno-hyoid and sterno-thyroid muscles, then by the corresponding lobe of the thyroid gland, and by veins which are sometimes of considerable size, and which empty into the internal jugular, it is as it were divided

into two portions by the omo-hyoid muscle at the middle of the sub-hyoid region.

This little muscle in fact transforms the side of the neck into two very regular triangular spaces. In the inferior or *omo-tracheal triangle*, bounded by the trachea, clavicle and muscular bundle in question, the artery concealed by the inner root of the sterno-mas-toid, does not present other than very simple relations except that in this situation it lies very deep; in the other or the *omo-hyoid triangle*, which is circumscribed by the border of the sterno-mas-toid outwardly, the transverse line which limits the sub-hyoid region above, and the omo-hyoideus muscle below, it is much more superficial; but it is in this place that we frequently find a venous plexus covering its anterior surface.

Nevertheless, the right carotid which is shorter, as is known, than the left carotid, because of the trunk of the innominata, and being also perceptibly nearer the median line and more superficial, owing to the trachea which raises it up near the sternum, is for that reason, almost as easy to reach in the *omo-tracheal* space, as in the *omo-hyoid* triangle.

B. *Anomalies*.—Among the varieties which the carotid arteries present, there are some that may occur, which the surgeon ought not to lose sight of. That of the right side may come directly from the aorta. At other times, the trunk of the innominata ascending higher than usual, of which M. Harrison cites an example, the carotid is thus found shortened to the same degree. Zagorsky has seen the left carotid and subclavian arise from a common trunk, while upon the right they were separate. I have seen, as have also A. Monro, Scarpa, A. Burns, Goodman, Meckel, &c., the two carotids arise from the trunk of the innominata, also originating by a common trunk from the aorta, distinct from the two subclavians; but it is rare that they separate into external and internal carotid at the lower part of the neck, as Burns and some others have noticed. M. Langenbeck has seen the primitive carotid divided into internal carotid and superior thyroid, and without giving off any external carotid; and Burns cites examples where the cephalic trunk did not bifurcate until at a level with the angle of the jaw.

§ II.—*Indications.*

The primitive carotid has been the seat of every kind of aneurism. Too often does it happen that we find it wounded by pointed or cutting instruments, giving rise to hemorrhage which speedily terminates in death. The patient who, after receiving a sword thrust in the ear died of hemorrhage, in the arms of Ravaton (*Chirurg. d'Armée*, p. 467, Obs. 4,) in spite of topical applications, tents (*tamponnement*) and compression, had been wounded in the carotid artery. It was the same with the one in whom a fatal hemorrhage took place, while a tumor was being extirpated from the neck, (*Cammerc. Litter. Nuremb.* 1733.) Sometimes, however,

the only result of such wounds is an aneurism, which, from being at first diffused, ultimately becomes circumscribed. Harder mentions a case of this kind in a soldier, whose carotid had been punctured by the point of a sword. M. Reid relates the case of a patient, (*Gaz. Méd.*, 1838, p. 282,) who having swallowed a fish bone, wounded the carotid and died at the end of ten days with vomiting of blood. At other times, aneurism is caused by violent movements; Rumler saw it produced in this manner, in a man who wishing to raise a heavy burden, threw his head violently backwards. Scarpa was witness to a similar fact in a soldier, who having been thrown from the top of a wall at Mantua, experienced a torsion and violent traction of the neck. Aneurism of the carotid may also arise without any appreciable cause, of which at the present day we possess numerous examples.

M. Larrey, (*Clin. Chir.*, t. III., p. 149—154,) M. Willaume, (*Allgemeine Med. Zeit.*, Avril, 1838.—*Arch. Gén. de Méd.*, 2e série, t. IV., p. 135,) and Desparanches, have seen varicose aneurism in this artery. We also have at the present time very remarkable examples of this kind. A student in philosophy receives a sword thrust in his neck. The first symptoms are subdued and are succeeded by a varicose aneurism, (Sabatier, t. III., p. 187.) An inhabitant of Martinique, receives a wound in the neck from a sharp pointed instrument. From that time he has a pulsating tumor in the carotid region. (Communiqué par M. Rutz, Mars, 1838.) A wound from fire-arms proves fatal in fifteen days; the autopsy discloses a communication between the internal jugular vein and the carotid. The ball was underneath and *in the jugular vein itself*. I have seen the specimen, (Commun. par M. Joret, médecin à Vannes, 1838.) The lesions of arteries of such large size, and which are the only ones which nourish the exterior of the head and the greater portion of the brain, must have necessarily created uneasiness in the mind of the surgeon when the conviction presented itself before him, that the cure could only be effected by proceeding at once to the obliteration of the wounded vessel.

B.—Galen and Valsalva, it is true, had already remarked that the ligature upon the carotid in dogs, is not attended with danger; but little was it then thought that this fact could be applied to man. To create confidence in the minds of observers on this point, other facts were necessary. Petit (*Acad. des Scienc.*, 1765) found the right carotid completely obliterated. In dissecting the dead body of a woman, Haller met with the same thing in the left carotid; Baillie (S. Cooper, *Opér. Cit.*, p. 155) found one of them entirely shut up and the other considerably contracted. Pellelian (*Clin. Chir.*, t. I., p. 68,) and M. A. Cooper, have each related a similar fact. If we may believe Koberwein, M. Jadelot saw this obliteration in both carotids at the same time. These examples, to which at the present day we might add many others, and especially that which I had occasion to observe in 1831, in a dead body delivered for dissection at the School of Practice, prove two things: first, that one of the carotids or even both may be closed,

without involving the death of the individual, or preventing the blood from reaching the brain; secondly, that aneurism on either of those vessels, left to itself, may in certain cases disappear spontaneously. (See case of M. Rossi, in a note *infra*.)

C.—The cure also of wounds and aneurisms of the carotid region, had been attempted by various methods. We already find in Verduc (*Pathol. Chir.*, p. 147) a compressing bandage devised for this purpose. Compression exercised with agaric, a bandage and the hand, cured a wound of the external carotid, in a case mentioned by Caestruck, (*Gazette Salut.*, 1767, No. 46.) Anel, V. Horn and M. Larrey, cite similar facts, (*Mém. de Chir. Milit.*, t. I., p. 309.) The method of Valsalva and refrigerants, employed in our time with some success by M. Larrey, (*Clin. Chir.*, t. III., p. 150,) has not been less efficacious in the hands of Delpech, (*Rev. Méd.*, 1824.) Attention was especially drawn to the ligature in cases of aneurism, because it did not appear possible to establish in the neck, between the heart and the aneurism, a sufficient degree of compression to allow of the sac being opened with the requisite degree of security. The surgeons of La Charité who, according to Harder, (Boyer, *Malad. Chirurg.*, t. II., ou *Appear.*, *Observat.*, Obs. 86,) were bold enough to undertake it, saw the patients perish under their hands. According to Hebenstreit, cited by M. S. Cooper, the carotid had nevertheless, been tied with success for a wound made during the extirpation of a scirrhus tumor from the neck, and also by Abernethy with success, for a traumatic lesion of the external and internal carotids. In 1803, M. Fleming was not less fortunate in a marine who had attempted to commit suicide. We find in the journal of Sédillot, a fourth example of this operation, for a wound in the neck. The patient died on the ninth day. M. Brown relates a fifth, which resulted in a cure. M. Collier furnishes a sixth, to which M. S. Cooper was a witness, and the treatise of M. Hodgson supplies a seventh.

D.—Be this as it may, it was in November, 1805, that an aneurism of this artery was for the first time treated by the method of Anel. The patient died on the twentieth day. M. A. Cooper had recourse to it again in the month of June, 1808; and this time with perfect success. In the month of September following, a patient operated upon by M. Cline, died on the fourth day. It was not until this epoch that the trials which had been made at London were known at Paris. In the year 1804, Dubois had every thing prepared for a similar operation, which did not take place, because the patient died suddenly the evening preceding the day upon which it had been arranged to perform it. I will add, also, that the operation had been formally proposed by Deschamps, the son, and by Horeau, (*Prix de la Soc. de Méd. de Paris*, an X., inédit,) in 1800 or in 1801. At present, it has been performed altogether, more than one hundred and fifty times, and to fulfil indications that are essentially different also from each other. More than forty of those operated upon have died, while eighty at least have survived; but it would be difficult at present to give the exact proportion of cures and failures.

E.—These operations have been performed, 1st, to remedy hemorrhage which was caused by wounds of the mouth, pharynx, face, cranium, ear, parotid region, and all other parts of the neck ; 2nd, to effect the absorption, (atrophier,) or cure of erectile tumors in the same regions, (See *Erectile Tumors*) and to arrest the development of certain fungous or cancerous tumors ; 3rd, to facilitate the extirpation of parotid, pharyngeal, and thyroidal tumors, (See the Parotid, and Tonsils) ; 4th, to enable us to remove the lower jaw, (See *Exsection of the Jaw*, infra) ; 5th, to cure certain diseases of the brain, or of the nerves which arise from it ; 6th, for aneurisms of the neck and head, (See *Compression of Arteries*;) 7th, for certain aneurisms of the trunk of the innominate or of the aorta itself.

F.—We may thus explain how the carotid artery has been tied so great a number of times in less than forty years. Here is the list of the cases which I have been enabled to collect.

I. For Aneurisms.

Dupuytren	- cured	- <i>Bull. de la Faculté</i> , t. IV., p. 46, <i>Rev. Méd.</i> , 1828, t. IV.
Chiari	- dead	- <i>N. Ippolito, Lig. dell'art. Verteb.</i> , 1837.
Porter	- cured	- <i>Dub. Hosp. Repts.</i> , vol. V., p. 211.
Molina	- Id.	- <i>Arch. Gén. de Méd.</i> , t. XVIII., p. 569.
Vincent	- dead	- <i>The Lancet</i> , Vol. II., p. 570.
Clellan, 3	- cured	- <i>The Lancet</i> , 1828, Vol. I., p. 715, <i>Journ. Hebdl.</i> , t. II., p. 7.
Chauvet	- Id.	- <i>Comm. by the Author</i> , 1837.
A. Robertson	- Id.	- <i>The Lancet</i> , t. I., 1838.
Warren, 15	- Id.	- <i>Private Communication</i> .
A. Cooper, 3	- 2. c. 1. d.	- <i>Med. Chir. Transact.</i> , 1806, 1809, <i>Œuv. Ch.</i> , p. 450.
Coates	- dead	- <i>Med. Chir. Tr.</i> , Vol. XI., p. 277.
Hodgson	- cured	- <i>T. II.</i> , p. 18.
Lyford	- Id.	- <i>Med. Chir. Tr.</i> , Vol. II., p. 97.
Macaulay	- Id.	- <i>Ed. Med. & Surg. Jou.</i> , t. X., p. 178.
Jon	-	- <i>Lisfranc, Thèse</i> , p. 130.
Key	- dead	- <i>The Lancet</i> , Vol. I., p. 190.
Cline	- Id.	- <i>Lon. Med. Rev.</i> Vol. II., p. 96.
Walther	- cured	- <i>Hodgson</i> , t. II., p. 83.
Dehaen	- Id.	- <i>Med. Gaz.</i> , Vol X., p. 34.
Gaunit or Gonnet	- Id.	- <i>Bérard, Dict.</i> , t. VI., p. 420.
Marschal	- dead	- <i>Jour. Hebdl.</i> , 1835, t. IV., p. 271.
Mott	- cured	- <i>Hodg.</i> , t. II., p. 36.
Post	- Id.	- <i>Mem. Biograph.</i> , p. 18.
Dupont	- Id.	- <i>Vanderhagen, Th.</i> , 1815.
Liston	- { for an. of subclav. }	- <i>Gaz Méd. de Paris</i> , 1838, p. 600.
Total, 43—cured 34, dead 7.		

II. *For Wounds, Ulcers, and Hemorrhage.*

Guthrie	- dead	- <i>Op. Cit.</i> , London, 1830.
Duffin	- id.	- <i>The Lanc.</i> , Vol. I., p. 587, 1829, Vol. II., p. 638.
Michon	- cured	- <i>Lanc. Jr.</i> , t. XII., p. 475.
Roux	- cured	- Wounded of July, 1830.
Larrey	- cured	- <i>Clin. Chir.</i> , t. II., p. 120—130.
Mayo	- cured	- <i>Bull. de Férussac</i> , t. XXI., p. 123. <i>Arch. Gén. de Méd.</i> , t. XXII., p. 117. <i>Gaz. Méd.</i> , 1827, p. 329.
Syme	- cured	- <i>Ed. Med. & Surg. Jour.</i> , 1833. <i>Arch. G.</i> , 2e série., t. II., p. 108.
Sisco	- cured	- <i>Annal. Univ. de Méd.</i> , 1829. <i>Bull</i> <i>de Férussac</i> , t. XXII., p. 446.
Forner	- cured	- <i>American Jour. of Med. Sciences</i> , 1832; <i>Arch. Gén.</i> , 2e. sér., t. I., p. 572.
Boileau	- cured	- <i>Arch. Gen. de Méd.</i> , t. VIII., p. 45.
Tyerman	- cured	- <i>Rev. Med.</i> , 1836, t. II., p. 423.
Flemming	- cured	- <i>Med. Chir. Trans.</i> , Vol. III., p. 2.
Miller	- cured	- <i>West Journal Med. & Surg.</i> , Vol. I., p. 425.
Hebenstreit	- cured	- Hodgson, t. III., p. 25.
Luke	- cured	- Guthrie, p. 326.
Brown	- cured	- <i>Ed. Med. & Surg. Jour.</i> , t. XIV., p. 106.
Dacrux	- cured	- <i>Jour. Hebd.</i> , t. III., p. 451.
Garrey	- cured	- <i>Trans. Med.</i> , 1833, p. 360.
Collier	- cured	- <i>Med. Chir. Trans.</i> , Vol. VII., p. 107.
Abernethey	- dead	- <i>Surg. Obs. Jour.</i> , p. 115.
Bedor	- cured	- <i>Presse Méd.</i> , t. I., p. 73.
Dupuytren	- dead	- Hodgson, t. II., p. 39.
Maurin	- cured	- <i>Jour. Hebd.</i> , t. II., p. 7.
Marjolin	- dead	- Hodgson, t. II., p. 44.
Travers	- cured	- <i>Bull. de Férus.</i> t. X., p. 286.
Giroux	- dead	- Hodgson, t. II., p. 45.
Cheyne	- cured	- <i>Arch.</i> , 2e sér., t. II., p. 108.

Total, 27—Cured, 21—Dead, 6.

III.—*For Erectile Tumors. Fungus.*

Dalrymple	- Cured	Hodgson, t. II., p. 15, <i>Méd. Ch.</i> <i>Trans.</i> , vol. VI.
Mussey	- dead	<i>Jour. des Prog.</i> , 2e sér., t. II., p. 262.
Walther	- dead	<i>Tarral. Arch. G.</i> , 2e sér., t. VII., p. 22.
Velpeau	- dead	Unpublished, 1835.
Willaume	- unsuccessful	<i>Jour. Hebd. Univ.</i> , t. II., p. 117.

Wardrop	unsuccessful	Hodgson, t. II., p. 82.
Pattison	cured	<i>Burns, Surg. Anat.</i> , p. 465—476.
Clellan	cured	<i>The Lancet</i> , 1828, vol. I., p. 715.
Kuhl	dead	2 cas, à 3 m. de dist., <i>Ency. Méd.</i> 1836, p. 131.
Delpech	unsuccessful	<i>Tarral, Arch. Gén.</i> , 2e sér., t. VI.
Travers	cured	<i>Med. Chir. Tr.</i> , vol. I., p. 222, or vol. II.
Bernard	cured	<i>Rev. Méd.</i> , 1833, t. III., p. 26,
Hall	cured	<i>Tarral, Op. Cit.</i> ; <i>Burns, Op. Cit.</i> , p. 485.
Rogers	cured	<i>Amer. Jour. of Med. Sc.</i> , 1833.
Mayo	dead	<i>Quarterly Rev. Jour.</i> , 1834, p. 411.
Arendt	cured	<i>The Lancet</i> , vol. XV., p. 116.
Dupuytren	unsuccessful	<i>Sec. Oral. Rép. d'Anat. et Ph.</i> , t. VI., p. 232.
Busk	cured	<i>Med. Chir. Rev.</i> , April, 1836, p. 184.
Bushe	cured	<i>The Lancet</i> , 1828, vol. II., p. 413.
Davidge	dead	<i>Burns</i> , p. 481.
Maunoir	unsuccessful	<i>S. Cooper, Art. Aneur.</i>
Roux	cured	<i>Bérard, Dict.</i> , t. VI., p. 422.
Peyroff, in- fant 9 mos }	dead	<i>Ann. der Ch. de Dorpat</i> , 1837, <i>Rev. Méd.</i> , 1838, t. III., p. 422.
Zeis, infant of 15 months }	dead	<i>Rev. Méd.</i> , 1838, t. III., p. 404.
Jameson	unsuccessful	<i>Burns, Surg. Anat.</i> , p. 480.
Machlachlan	dead	<i>Glasgow Med. Jour.</i> , 1828.

Total, 26—Cured, 11—Dead, 9—Unsuccessful, 8?

IV.—For the Removal of Tumors, &c.

Langenbeck	dead	<i>Arch. Gén. de Méd.</i> , t. XIX., p. 118, <i>Dict. de Rust</i> , t. II., p. 11.
Fouilloy	cured	<i>Arch. Gén. de Méd.</i> , t. XXVIII., p. 599.
Mayer	cured	<i>The Lancet</i> , vol. XIV., p. 174.
Stedman	cured	<i>Gaz. Méd.</i> , 1832, p. 529.
Awl	cured	<i>West. Med. and Surg. Jour.</i> , vol. I., p. 423.
Eckstrum	unsuccessful	<i>Bullet de Férussac</i> , t. VIII., p. 204.
Béclard	dead	<i>Arch. Gén.</i> , t. IV., p. 62, <i>Bérard, Dict.</i> t. VI., p. 434.
Warren	cured	<i>On Tumors</i> , p. 292.
Scott	dead	<i>Lond. Med. Gaz.</i> , vol. IX., p. 951.
Tarle	cured	<i>Ib.</i> , p. 374.
Gibson	cured	<i>Amer. Jour. of Med. Sc.</i> , v. XXVI., p. 505.
Flaubert	cured	<i>Voranger, Thèse</i> , No. 85, Paris, 1836, <i>Arch. Gén.</i> 2e sér., t. XII., p. 343.

Goadlad	cured	<i>Med.-Chir. Trans.</i> , vol. VII., p. 1., p. 112.
Magendie	unsuccessful	<i>Bull. de Féruss.</i> , t. XII., p. 253.
Palmi	dead	Kock, <i>Dessert.</i> , &c., 1831.
Kuhl	dead	Peters, <i>Thèse</i> , Leipsic, 1836.
Baravero	unsuccessful	<i>Bull. de Féruss.</i> , t. XII., p. 234.
Lisfranc	dead	<i>Arch. Gén. de Méd.</i> , t. XIV. p. 112—114, <i>Rev. Méd. Thèse</i> , 1834.
Gensoul	dead	<i>Lett. Chir.</i> , &c., 1833.
Fricke	dead	<i>The Lancet</i> , vol. II., p. 670.
Graefe	cured	<i>Mag. de Rust</i> , et <i>Thèse de Koch</i> .
Mott	cured	<i>Arch. Gén. de Méd.</i> , t. XXVII., p. 246.
Mott	dead	<i>New York Med. and Phys. Jour.</i> , v. II., p. 401.
Mayo	unsuccessful	<i>Lond. Med. Jour.</i> , 1827, Nov., p. 408.
Seutin	cured	<i>Jour. des. Sc. Nat. de Bruxelles</i> , Nov. 18, 1829.
Widmer	cured	<i>L'Exper.</i> , t. II., p. 336.
Total, 26—Cured, 12—Dead, 10—Unsuccessful, 4.		

V.—*For Diseases of the Head.*

Preston	1, '2	<i>Gaz. Méd.</i> , 1833, p. 76.
Liston	unsuccessful	<i>Ed. Med. and Surg. Jour.</i> , v. XVI., p. 73.
Total, 3.		

VI.—*Method of Brasdor.*

Wardrop	2	cured	1	M. Vilardebo, <i>Thèse</i> , 1831.
Busch		cured		<i>The Lancet</i> , 1828, No. 2, p. 149.
Montgomery		dead		Bérard, <i>Dict.</i> 6, p. 418, <i>The Lancet</i> , June, 1833, p. 421.
Fearn		cured		<i>Arch. Gén.</i> , 3e sér., t. II., p. 364, <i>recid.</i> 1838.
Morrison		dead		<i>Arch. Ibid.</i> , p. 369.
Rigen		dead		<i>Lettre Privée de M. Kerst.</i>
Tillanus		dead		<i>Ibid.</i>
Lembert		dead		<i>Arch. Gén. de Méd.</i> , t. XV., p. 441.
Evans		cured		<i>The Lancet</i> , 1828, vol. I., et Vilardebo, t. IV., p. 58.
Mott		dcad		<i>Amer. Jour. of Med. Sc.</i> , 1830, <i>Jour. des Progrès</i> , t. II., p. 262, 2e sér.
Key		dead		<i>Lond. Med. Gaz.</i> , July, 1830.
Total, 12—Cured, 4—Dead, 8.				

VII.—*The Arteria Innominata.*

Mott	dead	Burns, <i>Surg. Anat.</i> , edit., 1823.
Graefe	dead	<i>Jour. de Graefe et W.</i> , t. III., et IV.

Bland	dead	<i>Amer. J. of the Med. Sc.</i> , 1833, p. 509.
Hall	dead	<i>Arch. Gén</i> , 2e sér., t. VI., p. 267, <i>Baltimore Med. Journ.</i> , vol. I., p. 125.
Kuhl	dead	Peters, <i>Dissert</i> , &c., 1836.
Lizars	dead	The Lancet, June, 1837, p. 600.

Total, 6—Dead, 6.

General Total, 143—Cured, 82—Dead, 46—Unsuccessful, 13—Doubtful, 2.

§ III.—Operative Process.

The ligature upon the trunk of the carotid is generally of easy execution, and the mode of doing it varies but little.

A. *Ordinary Process*.—The patient should be laid upon his back, with his chest slightly elevated, the neck a little extended, and his face turned towards the healthy side.

I. *First Stage*.—The surgeon, placed on the diseased side, first seeks for the anterior border of the sterno-mastoid muscle, which is indicated to him by a slight depression, and then makes, in the direction of this border, an incision of about three inches in extent, which commences on a line with the cricoid cartilage, and terminates near the sternum, provided we wish to lay bare the artery in the *omo-tracheal* triangle. This incision, on the contrary, is prolonged a little higher, and not quite so low, when the disease admits of our applying the ligature in the *omo-hyoid* triangle. A second cut of the bistoury divides the platysma myoides, and the cervical aponeurosis, and lays bare the fibres of the sterno-mastoid muscle. The assistant draws the inner lip of the wound towards the median line. The operator having drawn its external and muscular lip to the outside, by means of the left fore and middle finger, omits the extension, inclination, or throwing back of the head, and then divides the fibro-cellular layer, which extends from the sterno-hyoid and thyroid muscles, to the posterior surface of the sterno-mastoid, and upon the fore part of the vessels.

II. *Second Stage*.—The omo-hoideus muscle is now seen under the form of a reddish bandelette; if it interferes too much with the action of the instruments, we divide it upon the director; but we can generally save it by drawing it out of its place to one side or the other; above and below are seen the vein and the artery, enveloped in their common sheath, whose anterior wall encloses the descending branch (filet) of the ninth pair. This sheath should be first perforated opposite to the artery, and not the vein, by means of the point of the director, then divided upon the same instrument with the bistoury, to the extent of an inch or two. When the jugular swells so much during the inspirations as to conceal a part of the carotid, and to embarrass the operator, we compress it near the upper angle of the wound, and it immediately shrinks, (s'affaisse.)

III. *Third Stage*.—The sound, held as a writing-pen, is then

passed between the two vessels; one or two fingers of the other hand hold the artery fast and prevent it from slipping towards the trachea, while, by gentle movements forwards and backwards, while making pressure on the point of the instrument, we reach its posterior surface, in such manner as to raise it without effort, and without being obliged to touch either the pneumo-gastric nerve, the great sympathetic, or any of their branches.

B. Remarks.—If we were to strike at first within the sterno-mastoid muscle, we should run the risk of confounding this fleshy bundle with the sterno-hyoid, and of being thus led astray; it is therefore better to cut upon its outer surface, and at the distance of some lines outside of its border, which latter it is always easy to bring afterwards upon a line with the wound of the integuments.

If, unfortunately, the jugular vein should happen to be opened, I do not know whether it would be better to tie it or to stop the hemorrhage by tents, (*le tamponnement*.) MM. Simmons and Miller (*Western Med. & Surg. Jour.*, vol. I., p. 425,) have, it is true, applied the ligature to it without difficulty, and the tents would oblige us to leave the wound open; nor had M. Gibson, in 1830, M. Stevens in 1832, nor M. Dugas (*Gaz. Méd. de Paris*, 1837, p. 298) since, any fear in surrounding it with a double ligature. The ligature has also been applied to it by M. Warren, (Communicated by the Author,) and by M. Widmer, (*Experience*, t. II., p. 336,) without difficulty. But to say nothing of phlebitis, which in this case is the most formidable consequence to apprehend, who would not hesitate in suddenly obliterating so large a vein at the same time with the principal artery of the head? If the wound were small, it would be prudent to pinch it with the forceps, and to bring its lips together and secure them with a ligature laterally, in such manner as not to shut up the calibre of the vessel. The patient upon whom M. Guthrie (*Oper. Cit.*, p. 328,) operated in this manner, died in consequence of a ligature which it was afterwards found necessary to place upon the carotid.

C. Process of M. Sédillot.—In order to come down perpendicularly upon the artery, and to have a wound more neat and of less depth, and which will give a more easy egress to the discharges, M. Sédillot (*Nouv. Bibliot. Méd.*, 1829, t. II., p. 63,) has proposed a new process for tying the carotid at the lower part of the neck. This incision, carried much further outwardly than in the ordinary mode, falls upon the outer side of the sterno-mastoid muscle, the whole substance of which, between its two roots, must be divided; the lips of this wound being held apart with the fingers by intelligent assistants, or by hooks, we come immediately in front of the vein and artery, which we have nothing more to do than to isolate. This process is practicable and ingenious; but it would be, if I do not deceive myself, less easy and less sure than the preceding. Consequently I do not think it should be exclusively adopted, but that it should be reserved only for particular cases.

D. Consequences of the Operation.—When the carotid is obliterated, the circulation is soon fully re-established in the correspond-

ing side of the neck and head; the voluminous and almost innumerable anastomoses which it contracts in the brain, with the vertebral and internal carotid of the opposite side; those which are established by the temporals, occipitals, supra-orbitars, facials, linguals, thyroids, superior and inferior; in a word, by all the branches of the external carotids,—form too vast a net-work to allow of our having the least uneasiness on this subject. We should rather have to fear that these resources, so valuable and for so long a time overlooked, might not jeopardize our success, by bringing too much blood into the tumor after the operation. This is, in fact, an inconvenience which we meet with; we have seen the pulsations in the aneurism at first diminish, and soon after reappear and be kept up for several weeks. In the patient operated upon by M. Walther, for aneurism of the external carotid, they continued for two months. We should, indeed, have difficulty in comprehending, if observation had not demonstrated the fact, how the ligature upon the primitive carotid could cure aneurismal affections as remote as those, for example, of the orbit, the face, and exterior of the cranium; but it is proved to-day that this reflux does not always hinder the tumor from being dispersed—that refrigerant applications and compression, moreover, co-operate in promoting this resolution, or, at least, in accelerating it when it is too tardy. The successful results enumerated in the preceding table sufficiently establish this point.

We are not, however, to conclude, therefore, that the obliteration of the carotid artery involves no danger. If M. Tuson, in advancing the proposition that it ought in some sort to be proscribed in sound surgery, has extravagantly exaggerated its danger, we must also admit that most surgeons impute too little importance to it. The patient of M. Gonnet was attacked with serious accidents before being cured. That of Abernethy died in delirium and convulsions. One of those of Dupuytren died from prostration, (adynamie,) probably from purulent infection, like one of mine. Inflammation of the sac, caused the death of those of Cline, A. Cooper, and M. Key. Another, operated upon by M. Key, and one of the patients of M. Langenbeck, died in less than two days from the destruction of the functions of the brain. Incipient paralysis took place in the cases of MM. Mayo, Sisco, Molina, and Zeis. The patient of M. Horner was seized with aphonia. An actual and complete hemiplegia took place in at least five cases, (Magendie, A. Cooper, Baravero, Vincent, and Macauley,) and one of the patients operated upon by me was also attacked with it. Abscesses and hemorrhages from the upper end, (le bout supérieur,) as in the case of M. Lisfranc and in one of mine; phlebitis, inflammation of the air passages and the viscera of the chest, are also among the consequences calculated to make the ligature upon the carotid a serious operation.

ARTICLE IV.—LIGATURE UPON THE TRUNK OF THE CAROTID,
ACCORDING TO THE NATURE OF THE DISEASE.

§ I.—*Wounds.—Hemorrhages.*

In cases of wounds the ligature of the carotid cannot in respect to the mode of operation be subjected to fixed rules. The operation should then be performed after the method of Keisler, or according to the rules laid down in the chapter on diffused aneurism and arterial wounds in general. It is consequently upon the bottom of the wound itself or opposite to the wounded point of the artery, that we are to operate in order to seize the vessel, and not upon the region where it would be most easy to reach it. Another peculiarity of wounds of the carotid and its branches is, that unless it is found wholly impracticable to do so, there must be a ligature placed both below and above the division. Otherwise the hemorrhage in fact might be kept up, by means of anastomoses from the upper end of the artery; under this point of view wounds of the carotid may be compared to those of arteries of the hand or fore-arm and of the foot or leg. Because a single ligature has sufficed for the cure in certain cases, we are not therefore to conclude that it is generally unnecessary to apply two.

§ II.—*Aneurisms.*

If the aneurism which renders a ligature upon the carotid necessary, should be situated in the neighborhood of the parotid region, the operative process which I have described above is applicable to it in every particular. But whenever it is of large size or descends down to a level with the larynx, the manipulation can no longer be so simple. In that case we are obliged to commence the incision lower down and to prolong it to near the sternum or even upon the anterior surface of that bone. M. Mayo in fact in one of his patients was obliged to divide the inner portion of the sterno-mastoid muscle, in order to arrive at the trunk of the carotid artery. In such cases also the larynx or the muscles are displaced to such extent as to change in part the relations which I have pointed out above. We cannot expect to find therefore in such cases any other guide than that which is to be obtained from a profound knowledge of the anatomy of the region, and from the carotid tubercle of the sixth vertebra.

§ III.—*Varicose Aneurism.*

The examples of varicose aneurism observed by M. Larrey, (*Clin. Chir.*, t. III., p. 149, 154,) M. Willaume and M. de Noter (*Mém. de la Soc. de Méd. de Gand.*, p. 192,) and lastly by M. Kuhl, (*Encyclog. Méd.*, 1836, p. 131,) M. Jorret, (Private communication, 1838,) and M. Ruz, (Private letter, March, 1838,) prove that the

carotid like all other arteries is liable to this disease. Only that the position of the head appears to me to render varicose aneurism in this region less inconvenient even than upon the limbs. In other respects, if it should produce symptoms so alarming as to oblige us to attempt a radical cure, it would be proper as in those of the arm, to tie the artery both above and below the point of communication, if the operation should not be found too difficult. In the contrary case there would be room to hope that a single ligature below would in most instances suffice.

§ IV.—*Erectile Tumors.*

When a ligature is to be placed upon the primitive carotid artery for erectile tumors of the head, we may proceed exactly in conformity to the rules laid down for the operative process. As all the organic tissues of the carotid region retain in that case their natural position, we are enabled to make choice of the place where the artery can be reached with the greatest ease. But then the question may often arise whether we should rather tie the primitive or the external or the internal carotid. Whether in place of tying one of the common carotids, it would not become necessary after the example of MM. Mussey, Kuhl and Langenbeck, to tie both. As these questions in no respect change the operative process itself, I shall not discuss them until I come to the chapter upon erectile tumors.

§ V.—*Various Tumors.*

The preceding remarks are applicable also to the various tumors which have been thought to require a ligature upon the carotid trunks. It is in fact readily perceived that these tumors when situated upon the head, leave the sub-hyoid region perfectly free, and in no manner interfere with the manual of the operation. On the supposition that they should exist in the neck, in the body of the thyroid or parotid gland for example, they would require the same precautions as for an aneurism in those regions. I cannot however understand how a ligature upon the carotid should be had recourse to with the view of arresting the development or nutrition of a fungus, or of any cancerous tumor whatever.

§ VI.—*Operations on the Face or Neck.*

When the carotid has been tied in operations upon the face, the parotid region or the thyroid body, we have been governed by the rules which belong to two different conditions of the parts.

If, as happened to Béclard and M. Warren, the artery has been unavoidably wounded during the operation, we must proceed as in the circumstances for wounds in general, that is, while an assistant makes compression between the wound and the heart, we must

immediately seek for the lower end and then the upper end of the divided vessel, and in this manner apply the two ligatures.

Upon the supposition on the contrary that we wish to tie the artery previously, as I have done in a case where I had to remove an enormous cancerous tonsil, as MM. Graefe, Palmi, Mott, Awl, and a great number of other practitioners have done, before extirpating the thyroid, disarticulating the lower jaw, or removing parotid tumors, the operation would be quite simple, and would be regulated by the rules of the general operative process.

§ VII.—*Neuralgia.*

Supposing that any one were disposed to follow the suggestion of M. Preston or M. Liston, and tie the carotid for nervous affections of the head, it would be a case where the operation evidently would present the greatest degree of simplicity; but as hemiplegia not unfrequently results from the operation itself, we cannot comprehend why M. Preston should have tied the carotid for the cure of hemiplegia. The patient operated upon by M. Boileau, and who was epileptic, continued nevertheless to have paroxysms after the obliteration of the vessel. Here was a fact ascertained which should have deterred M. Preston from unnecessarily exposing the life of an epileptic, in whom he vainly attempted to effect a cure by a ligature upon the carotid. The failure of M. Liston, also, shows how irrational it was to place a ligature upon the carotid for the purpose of relieving a simple neuralgia.

§ VIII.—*Method of Brasdor.*

If, in place of applying the ligature upon the carotid by the method of *Anel* or by the ancient mode, we should choose that of *Brasdor*,* this process has nothing in addition peculiar in its manipulation, except that the incisions should be made a little higher up than in the preceding cases, and that we must lay bare the artery in the omo-hyoid triangle, and in the neighborhood of the great horn of the os hyoides. We shall see, moreover, in the following articles, what we have to expect from this method when applied to aneurisms at the apex of the chest, and at the lower part of the neck.

[LIGATURE ON THE PRIMITIVE CAROTID.]

Primitive Carotid tied near the Innominate.—A large tumor in a boy, which Mr. Liston considers to have been originally of a scrofu-

* As an aid to the memory of the student, it may be remarked, that he will always readily remember the two great processes for aneurism, by minding his A. B. C. D. Thus, *Anel's* was the *Cardiac* and *Brasdor's* the *Distal* side of the aneurism; i. e. A. C., B. D. So the late Professor Hossack, in his lectures on midwifery, used to say to his hearers that they could always recollect that there were *two* arteries and *one* vein in the umbilical cord, by calling to mind the orthography of the name of the great Boerhaave; i. e., two AA's and one V.—T.

lous character, occupying the whole space from the arch of the palate behind the angle of the lower jaw on the right side, and extending near to the sternum, compelled him, after he had decided on the step to take up the carotid close to the innominate. From Oct. 20 to Nov. 3d, things went on well, and the tumor had diminished sensibly, when a sudden hemorrhage from the wound caused death. The artery was nearly ulcerated through by the ligature, but had no coagulum. M. Liston is of opinion the ulceration came from without the vessel; i. e., from pus in the tumor making its way into the artery. It is, however, manifest that the subject must have been a bad one, and that in such cases there is too much probability of arterial degeneration, especially the nearer we go to the great trunks about the innominate. (See Lond. Med. Gazette, March 18, 1842.)

Carotid tied in two cases, by Dr. Duncan, for Carotid Aneurism.—Dr. Duncan read, at the Medico-Chirurgical Society of Edinburgh, May 1, 1844, (see Cormack's *Monthly Journal*, Aug. 1844, p. 728,) a case of much interest: a woman aged 33, in whom a carotid aneurism had attained such rapid growth, in the short space of three weeks, that it extended from the angle of the inferior maxillary bone to about two fingers' breadth from the clavicle. Two or three days after, she was seized with spasmodic attacks of dyspnoea, one of which was followed by a state of complete insensibility, the pulse being almost imperceptible, and the respirations only five in the minute. Tracheotomy was performed by Dr. Duncan; and on her rallying, he proceeded, from an apprehension that the sac of the aneurism might give way, to tie the vessel. Everything went on well until the 12th day, when inflammation of the sac of the aneurism followed, and a small ulcerated communication with the pharynx formed. The sac was then freely incised, and the coagula turned out, but the woman died on the 15th day. No morbid appearances sufficient to account for death were found at the post mortem inspection; and it was believed the cause of death was *spasm of the glottis*, induced by irritation of the recurrent nerve, which was involved in the tumor. The obliteration of the artery was found to have been perfectly completed.

Dr. Duncan, at the meeting of the same society, May 13, 1844, (Cormack's Soc. Cit., p. 733,) stated he had also tied the carotid on account of hemorrhage following extensive ulceration of the fauces; but the patient died the 14th day, in consequence of an attack of bronchitis. In this case, though the interval of time that the patient survived was nearly the same as in the case last mentioned, the *distal portion* of the artery above was found closed only with an internal coagulum of about half an inch in length. The dissected ends of the artery were separated from each other by more than one third of an inch, and *without any* effusion of lymph betwixt them. The *cardiac* end of the vessel was patent for about an inch from its divided extremity, and at this point was blocked up by a coagulum about three quarters of an inch in length, which alone had prevented the occurrence of secondary hemorrhage. But

Dr. Duncan is of opinion that, had the patient not perished as he did, secondary hemorrhage would in all probability have ensued, as softening of the coagulum had already commenced.

Both cases, in our opinion, throw much light on the pathology of divided arteries, proving that an aneurism does not always imply, even in cases not traumatic, that an aneurismal degeneration of the arterial coats has proceeded to any great extent beyond the sac; not to such extent, in fact, as in cases of general vitiation of the constitution, which probably was the condition of the last patient.

The death in both cases from accidental pulmonic causes, also shows how important it is, in such as in all other cases, that a sound therapeutic should be kept constantly in view, and be promptly resorted to after surgical operations; which, skilfully as they may be performed, too often fail to complete the cure, unless medical treatment as the adjunct of the knife, is carefully and vigilantly attended to. Such cases show also how dangerous, not to say preposterous on its very face, is the too prevailing notion that surgery should aristocratically disdain to meddle with medical practice strictly so called, or to look beyond the mere adroitness and rapidity of cutting; in other words, the mere carpentry or mechanical part of the profession, when, in fact, every department of the healing art is so closely blended with, and dependent upon all others, that no one branch can be separated from the rest without endangering the whole superstructure.

The left *common carotid* was tied on May 29th, 1842, by Mr. James Spence, surgeon at Edinburgh, (*Cormack's Lond. and Edinb. Monthly Journ.*, May 1843, p. 439, &c.) for a hemorrhage from ulceration of the face in a man aged 38. This patient had had a running from the left ear from childhood. In March, 1842, when first seen by the surgeon, the whole of the left side of the face over the parotid and temporal regions, and upper part of the neck, were greatly swollen and discolored, hard and tense, and with a deep-seated fluctuation over the zygoma, while the temporal artery was seen pulsating on the surface of this swelling in the temporal region. A thin, sanious discharge came from the left ear, the external meatus of which was nearly filled up by a large fungous excrescence. From inability to eat solid food, and from the severe pains at night, he was greatly exhausted. These symptoms seemed to be relieved by evacuating a quantity of fetid pus from the fluctuating region mentioned, by means of a free incision over the zygoma. Abscesses, however, soon re-formed there, and were opened, but continued to emit foul discharges, and exhibited pale and flabby edges, the zygoma itself being now bare. A slight arterial bleeding, in April, from one of the incisions, was arrested by compression; but the patient became daily weaker from night sweats and diarrhœa. The surgeon apprehended, from the condition of the parts, hemorrhage from ulceration of the branches of the external maxillary artery, or the superficial temporal. The patient went into the country, applied caustic to the ear, which only made the fungoid growth there spread more rapidly and more

malignant in character. Again, on May 29th, a violent bleeding ensued, to the quantity of two or three pounds of fluid blood, from one of the old incisions on his face, which, threatening a fatal issue Mr. Spence, when reaction took place after the exhaustion, properly proposed, with the approbation of Sir George Ballingall, a ligature on the common carotid as his only chance.

From the swollen, infiltrated state of the upper part of the neck, the incision was directed in such a manner as to reach the vessel below the omo-hyoid, and to have no greater extent than a *quarter of an inch*. The want of light, and of proper instruments to hold open the edges of the wound, (as it was at the patient's residence,) prolonged the operation, which, however, was carefully completed by cautiously separating the artery in its sheath, and passing the aneurism needle under it from without to the tracheal side, bringing its point out with the dissecting forceps, *without raising up the artery*. Both ends of the ligature were left outside the wound, which was brought together by *three* stitches of interrupted suture, when the patient was laid in bed with his head raised, and a pledget of lint, dipped in cold water, kept over the part. The operation was performed at quarter past eleven A. M., and at 2 P. M. there had been no bleeding from the face. The pulse was 98, and tolerably full, there was some pain in the wound on swallowing, but the respiration was easy and natural, and without cough. The favorable symptoms continued, and on May 31, the stitches were removed, and the edges of the wound were nearly united, and in a healthy state. The swelling of the face had diminished, but the ulceration of the ear continued to spread. On June 5, however, secondary hemorrhage supervened to considerable extent; it was found that the ligature had not completely separated, and the bleeding seemed to come from the lower part of the artery, the wound itself being without extravasation or purulent deposit, but pale and flabby. Compression was thought preferable to tying the vessel nearer the heart, and thus endangering more ulceration and secondary hemorrhage. A dossil of lint was passed over the bleeding point, secured by a graduated compress and a roller obliquely across the neck, and under the arm-pits. This completely arrested the hemorrhage, and the next day his pulse was 98 and soft, and he felt easy. On June 14, there having been no more bleeding, the compresses were removed, and the edges of the wound brought together by adhesive straps. The wound gradually contracted, but the fungous ulceration of the external ear, which was now half destroyed, spread with frightful rapidity, laying bare the articulation of the lower jaw. On June 25th, coma came on, and a profuse discharge of dark blood from the ear, which was arrested by plugging with lint, as the fungous growth in the meatus had entirely disappeared. Some relief ensued, and the patient was rational and talked, but on July 4, coma returned, and ended in death.

A *post mortem* was not permitted, but the carotid was examined. Granulations were found at the bottom of the wound, the divided ends of the vessel, connected by a quantity of firm lymph, effused

around them, and the par vagum and internal jugular of their natural appearance. The *internal coats* of the artery were found fairly divided, and their ends retracted to some distance from each other, and adhering to the external cellular coat. There was no appearance of a clot in the vessel, either above or below the ligature, so that the lymph effused around and between the cut ends of the cellular coat seemed the only obstacle to hemorrhage taking place.

In remarking upon the fatal issue, Mr. Spence very naturally asks himself the question:—"How far might a cautious use of nutritive diet, with a view to increase the plasticity of the blood, have been a preferable mode of treatment to the exhibition of *antimonials*; and the other means (which were) used to diminish the force of the circulation; as it appears to me that in this case the secondary bleeding was owing to the weakened powers of the patient being inadequate to effect the healthy changes necessary to procure obliteration of the artery." This is unquestionably the sound doctrine, and the facts since disclosed by the new and successful treatment of aneurism by compression by the Dublin surgeons, (vid. our note above,) prove its truth as common sense does. Mr. Luke [see his case of Tubular Aneurism in a note above. T.] also leans to this pathology. But the fungoid cancerous ulcer of the ear, and the general condition of the face, showed that there was internal vitiation of the fluids which no surgical operation, nothing in fact but constitutional therapeutic means could repair. The hemorrhage, however, antecedent to the operation, was a bare justification of the knife in so extreme a case of general vitiation of the system and parts affected. The compression by *pieces of sponge impacted into the wound* by Dr. Mott's process, (see note above,) would have been preferable; but the other mode answered, as the force of the circulation was exceedingly feeble. Dr. Mott invariably makes it a practice on the carotid, subclavian, &c., gently to raise up the artery alone from out of its sheath at the bottom of the wound, by means of the blunt hook, so that it may be distinctly seen to be perfectly separated from all its important connections, and its pulsations and arterial character *satisfactorily demonstrated* to the operator and others, by pressing the point of the finger moderately upon the artery while it is upon the hook.

From the failure of this case, M. Spence was induced to make a series of experiments on the *ligature of arteries*, and the mode in which obliteration is effected. He detailed his views (Cormack's London & Edinburgh Monthly Jour., May 1843, p. 492,) before the Edinburgh Medico-Chirurgical Society, accompanied with prepared specimens. The results lead him to believe that too little attention had hitherto been bestowed on the *lymph effused external to the canal of the vessel*, and which he thought was of service in two ways: 1st, by surrounding and pressing upon the vessel for some distance above and below the ligature, so as to diminish the calibre of the artery, and to lessen the impulse of the blood at that part; 2d, he considered it to be of still greater and more direct use at the period of the separation of the ligature, at which time as the pre-

paration showed, the lymph had begun to connect the divided ends of the artery, and continued to be effused between the ends of the vessel in the track made by the ulcerative process for the separation of the ligature. (This goes to confirm the learned and ingenious experiments which have been made by M. Velpeau and others, at Paris, on the subject, to determine the nature of the process in the formation of the material interposed in the space left by the retracted ends of tendons subjected to the sub-cutaneous division ; to which great salutary, reparative, or recuperative organic action of nature, the formation of the substitute material deposited in the interval made by the division of arteries, veins, &c., is very analogous, if not precisely the same.—See Vol. I.)

M. Guérin, (*Gaz. Méd. de Paris*, t. XII., 1844, p. 659,) doubts entirely the reasoning of M. P. H. Bérard, (*Dict. en 25 vol.*, t. VI., p. 430,) which attributes to cerebral hemorrhage the hemiplegia which sometimes follows a ligature upon one of the carotids. M. Guérin cites the case of a dissecting aneurism on the aorta, innominate and right carotid, in which the last vessel was obliterated a short distance from its origin. The patient (See *Dublin Medical Press*, April, May, and June, 1844,) was aged 37, robust and plethoric, and was suddenly seized with fainting and died in 11 days after having suffered much distress about the loins, suppression of the urine and paralysis of the left side. The brain was found *softened* and exsanguined—with no evidence whatever of effusion of blood, says M. Guérin. The brain he supposes is paralysed for want of the stimulus of blood, not from too much of it—in the same way as Stenon and Legallois found the hind legs of rabbits soon paralysed by a ligature on the abdominal aorta, for want of the stimulus of blood upon the nervous centres.

Ligature on the Primitive Carotid for Aneurism of a secondary branch of the External Carotid.—Mr. Kerr (*Edinburgh Med. and Surg. Jour.*, January, 1844) relates the case of a remarkable tumor on the right side of the neck in a woman aged 67, and which had existed 30 years, but only in latter years had increased to such size as to extend from the angle of the jaw to the sternum and clavicle. It had the same diffused expanded strong pulsations of all aneurisms, and these were synchronous with those of the heart. Gangrene took place followed by occasional slight hemorrhages ; when the external parts having sloughed and healed, the hemorrhage ceased, and the tumor at the end of a month was found to have sensibly diminished. Great doubts existed if it was an aneurism, and if so, it was supposed to be of the primitive carotid near its bifurcation, as the trunk of this artery had been crowded to the outside by the tumor, and its pulsations were distinctly felt, and when arrested by compression, caused also those of the tumor to cease.

The primitive carotid was tied at its upper part ; the pulsations of the tumor ceased, and its volume at the end of nine months was diminished to half its original size ; when an attack of pneumonia came on and proved fatal. On dissection the carotid artery being carefully exposed from its origin to beyond its division, was found

obliterated to a certain extent; *but the tumor had no communication with this vessel*, and did not present those concentric layers which are found in ancient and obliterated aneurisms. It was found in communication only with a secondary branch of the external carotid, and appeared to be formed of cellular tissue and vessels mixed with blood. This may perhaps be considered a good specimen of circumscribed false aneurism, or the varicose aneurism of A. Bérard, but not aneurism by anastomosis nor erectile tissue, (See note on M. A. Bérard's cases, *supra*.)

Wounds of the Carotid causing Aneurismal Varix and Varicose Aneurism.—Veterinary surgery again comes to the aid of our art in relation to some new pathological results noticed by M. Rey, Professor at the Royal Veterinary School of Lyon, (See Jour. des Connaiss. Méd.co-Chir., Paris, Janvier, 1843, p. 20, et seq.) in *puncturing the carotid while opening the jugular vein for bleeding*. Two cases have fallen under his observation, the lancet in both having been used instead of the fleam (flamme.) 1. In the first a mule aged 15 years, the carotid alone owing to a sudden movement of the animal was punctured. The professor immediately applied to it the *twisted suture with three pins*; a large tumor formed immediately afterwards, which, in confirmation of the present revived mode of healing aneurisms by compression, and also wounds of the brachial artery in the human subject in bleeding, was entirely dispersed, and a perfect cure effected in *two days* by a containing bandage, vigorous compression, acidulated lotions and diet; 2. In the second case the *aneurism* which the application of a ligature to the vessel could not prevent [the ligature must have been on the *distal* side of the artery, we presume. T.] was cured by refrigerants. Both the cases were probably aneurismal varix of the artery, (See the diagnosis of this in our note on M. A. Bérard.)

In another case which is the most important of all, arteriotomy (i. e., of the carotid) was performed as an experiment, and was followed by no unpleasant result, though the animal was left to himself. T.]

ARTICLE IX.—THE TRUNK OF THE INNOMINATA.

When aneurisms are situated upon the lower part of the carotid, it is no longer practicable to treat them by the method of Anel, unless by placing the ligature upon the trunk of the innominata; and should this last-mentioned trunk itself be affected, it would seem at first that the disease was beyond the resources of art. When, on the other hand we consider that in a great number of cases, the precise seat of the aneurismal tumors in the lower part of the neck, and in the supra-clavicular region, and at the apex of the thorax, is exceedingly difficult to determine, it is easy to conceive what must be the embarrassment of surgeons, under such circumstances, when the question comes up of applying a ligature upon the artery which is diseased.

§ I.—*Method of Brasdor.*

As a remedy, in part, for these difficulties, the method of Brasdor has been, at the present day, often had recourse to upon the neck. It is a method also which numbers now a sufficient number of trials to require that it should be examined with care. Though all the surgeons who have made trial of it have done so, upon the supposition that it was for an aneurism at the origin of the carotid; they have frequently found, however, that they had to do with quite a different affair. Thus, one of the patients of M. Wardrop had an aneurism of the brachio-cephalic trunk, and this surgeon, not perceiving the pulsations of the carotid, placed the ligature upon the subclavian. There is reason to believe, also, that the arteria innominata was the seat of the aneurism, in the cases of M. Evans, M. Key, and M. Mott. M. Montgomery, who supposed he was operating for an aneurism of the carotid, was enabled to ascertain, four months later, that the disease was seated in the arch of the aorta. We may add, that in another case, where M. Wardrop had supposed that he had embraced the carotid in a ligature of the intestine of a silk-worm, this artery, at the end of three months, was found perfectly free, without its being possible to say exactly what had become of the aneurism. Nevertheless, one of the cases of M. Wardrop, that of M. Evans, and also that of M. Bushe, demonstrate, unquestionably, that certain aneurisms, at the apex of the thorax, may be cured in this manner.

It might seem *à priori* that the ligature in the hyoid region might suffice whenever the aneurism is situated upon the carotid only; but that it would be necessary to combine with it the ligature upon the subclavian also where the trunk of the innominata itself is affected. But M. Kerst of Utrecht has communicated to me two facts which, with those of MM. Evans (*Vilardebo, Thèse, etc.*, p. 58) and Montgomery, prove indisputably that the ligature upon the carotid alone may not only arrest the development of aneurisms upon the trunk of the arteria innominata, but also those of the arch of the aorta.

A man was received into the Civil Hospital of Amsterdam with an aneurism which projected above the sternum. M. Tillanus supposing it an aneurism of the left carotid, tied this artery a little higher up. The patient got well. Five months after he suddenly died. The aneurism, which was seated upon the arch of the aorta itself, was completely filled with a white coagulum, (*caillot blanc*.) The specimen is preserved in the cabinet of pathological anatomy at Amsterdam. In the other case the aneurism which was on the point of bursting (*s'ouvrir*) was found in the same situation. Believing also that it was an aneurism of the left carotid, M. Rigen of Amsterdam tied this artery at some inches higher up, on the 21st of February, 1829. The dangerous symptoms disappeared, and the size of the tumor diminished considerably. It became necessary to operate upon this man for a strangulated hernia on the 9th of

May following ; but he died on the 13th of June with symptoms of spasm or asthma. The autopsy showed that the aneurismal sac occupied the arch of the aorta between the left carotid and the trunk of the innominata. As in the case of M. Tillanus, it was filled with a white coagulum and considerably diminished.

We see therefore that the ligature upon the carotid artery, by the method of Brasdor, deserves to be tried even in cases where the aneurism appears to have extended to the aorta. Nevertheless the question constantly presents itself to my mind whether the chances of success would not be greatly increased by the simultaneous or subsequent ligature upon the subclavian artery. Only that there remains a doubt whether the internal mammary, the vertebral and inferior thyroid artery, &c., might not be sufficient to keep up the circulation in the root of this vessel and thus destroy all the effect of the ligature in reference to the aneurismal sac.

§ II.—*The Ligature upon the Brachio-Cephalic Trunk itself.*

A. *Anatomy*.—The trunk of the innominata, which is about two inches in length, and which reaches from the right antero-superior portion of the arch of the aorta to the level of the sterno-clavicular articulation, where it bifurcates to give origin to the right subclavian and carotid, takes a direction slightly oblique from below upwards, and from within outwards and from before backwards. The pleura covers its outer side ; behind it rests against the front and right side of the trachea ; its anterior face is crossed above by the left subclavian vein, and lower down by the vena cava descendens, which is parallel to it and separates itself more and more from it, as it approaches the right auricle. It is afterwards covered only by the cellular tissue, the root of the hyoid and sterno-thyroid muscles, the upper portion of the right side of the sternum and then to a small extent by the sterno-clavicular articulation upon the same side.

Anomaly.—This remarkable artery presents numerous varieties ; it may be wanting altogether or be found on the left side ; be longer or much shorter ; give off at the same time both the right and left carotid ; or it may originate from the left side of the aorta, cross the whole breadth of the trachea and nevertheless pass to the right side. I have once seen it, and two similar cases were shown to me in the pavilions of the School of Practice, pass to the left, across the trachea, turn round this canal from before backwards, and crossing the posterior surface of the œsophagus and the vertebral column, reach the line of the first rib, and then divide as usual. (Anat. Chir., t. I., Rég. Sous-hyoid : Sommet de la Poitrine ; région sous-claviculaire.)

B. *Indications*.—Aneurisms of the brachio-cephalic trunk have been observed in a great number of instances. Sharp, A. Burns, MM. Mott, Graefe, Wardrop, Devergie, Vosseur, &c., have published several examples of them. Spontaneous aneurism either by dilatation or by rupture of the internal and middle coats, is, nevertheless, almost the only one which is to be met with in this artery.

It was an aneurism of the trunk of the innominata, which, opening into the trachea, strangled the individual mentioned by Malouet, (*Bibl. de Planque*, in 4to., t. V., p. 278.) The case that M. Focke (*Dissertatio Med.*, etc., 1835,) published, included also the arch of the aorta. M. Genest, (*Arch. Gén. de Méd.*, t. XXVI., p. 205,) describes one which extended up as high as the chin. In a patient of M. Martin Solon, (*Arch. Gén.*, Mars, 1836.—*Gaz. Méd. de Paris*, 1836, p. 357,) an aneurism of the aorta had obliterated the brachio-cephalic trunk as well as the vena cava; yet the circulation, notwithstanding, continued in the arm.

A case of Pelletan, in which it is seen that the subclavian, the right carotid, and the termination of the arteria innominata were obliterated during life without causing any serious symptoms; the case related by M. W. Darrach, in which it is seen that the trunk of the innominata and the left carotid had completely closed, prove that the circulation may be kept up in the upper limb, though the brachio-cephalic artery has ceased to be permeable to the blood. Surgeons have been emboldened by this to attempt a ligature upon it when the aneurisms of the neck are situated too low down to allow of its application to the carotid itself.

C. *Appreciation*.—M. Mott, (A. Burns' *Surgical Anatomy*, edit. Pattison, 1823, p. 433–456,) who was the first to perform it, in the case of a man aged 27 years, on the 11th of May, 1818, for a moment indulged the hope of seeing the operation crowned with complete success. Death did not occur till the twenty-sixth day. The circulation had re-established itself in the limb. On the twentieth day the patient was so well that he was enabled to walk in the garden of the hospital; but on the twenty-third day, repeated hemorrhages ensued, and the man died in a state of extreme exhaustion. There was neither inflammation in the aorta, the lungs, nor the pleura; a firm and adherent coagulum filled a part of the trunk of the innominata below the ligature; an ulceration, situated upon the other side of the artery, was the cause of the accidents. In 1822, M. Graefe, (*Edinburgh Medical & Surgical Journal*, vol. XLIX., p. 471.—*Jour. de Graefe et Walther*, t. III., c. IV.—*Dictionnaire de Chirurgie*, de Rust, t. II., p. 81,) repeated the operation of the Professor of New York; his patient lived sixty-eight days, and died only from his having made imprudent efforts which gave place to an abundant hemorrhage; the ligature came away on the fourteenth day. Though not conclusive, these two results nevertheless demonstrated that the ligature upon the trunk of the innominata presents some chance of success, and that it might be made trial of, if art possessed no other resources, in cases where the patient seemed doomed to an inevitable death. Thus has it been repeated at least four times since; the issue has been unfortunate; the four patients died. That of M. Bland, (*The Lancet*, January, 1837, p. 607,) died of secondary hemorrhage, on the eighteenth day, and the aneurism was situated upon the right subclavian artery! In the case of M. Hall, (*American Journal of Med. Science*, No. 22, p. 509,) death took place on the sixth day, and was

preceded by dyspnœa, acute pains and an issue of black blood from the wound; that of M. Lizars, (*Baltimore Medical Journal*, Vol. I., p. 125.—*Arch. Gén. de Méd.*, 2e série, t. VI., p. 267,) operated upon the 31st of May, 1837, died on the 21st of June, in consequence of hemorrhage. There were twenty ounces of blood in the chest, and the subclavian artery, which was the seat of the aneurism, might have been tied between the tumor and the carotid! In the sixth example, in the case of a cancerous tumor in the neck, the roots of the carotid and subclavian were tied together, on the 26th of September 1836, at the Hospital of Leipsic, under the impression that the carotid alone was tied. The case is too remarkable to omit giving the account of it in this place.

The patient, who was forty-three years of age, having been properly seated in an elevated chair, the head inclined to the left side, and held by assistants, M. Kuhl (E. O. Peters, *Dissert. Inaug.*, in the appendix at the end. Leipsic, 1836) made his first incision on the anterior border of the sterno-cleido-mastoid muscle, from the cricoid cartilage to the sternal portion of the clavicle. After having divided the skin, platysma myoides and fascia of the neck, he perceived the sterno-cleido-mastoid muscle; the external jugular vein was wounded and tied. The lips of the wound being kept apart by Arnault's hooks, the operator readily reached the bottom to separate, by means of the finger, the parts in the neighbourhood of the artery, to wit: the internal jugular vein, the par vagum, the descending branch of the hypo-glossal nerve, and the omo-hyoideus muscle. After all these difficulties, we were astonished, says M. Kuhl, not to find the division of the common carotid near the larynx; I found it, finally, near the clavicle, where I tied it. The patient died on the third day.

Half of the arteria innominata, a portion of the carotid, and a portion of the subclavian artery, were surrounded with a layer of plastic lymph. We found the right carotid and subclavian tied together at three lines above their origin from the trunk of the innominata; their coats were ruptured, and their canal in part obstructed.

Six trials, by six different surgeons, of different countries, have ended in six fatal results! Is it not enough to enable us to pronounce an inexorable verdict upon such an operation? At the present day therefore I do not hesitate formally to proscribe it, not only because of the dangers which accompany it, but also because the aneurism which requires it is often of a difficult diagnosis, and especially because, as I have said above, the ligature beyond the tumor and by the method of Brasdor, presents at the same time less difficulty and more prospect of success. This however is the mode of operating.

§ III.—Operative Process.

A. *Process of M. Mott*.—M. Mott made an incision about three inches above the clavicle, and which extended from the outer part of the sterno-mastoid muscle, to the fore part of the trachea; then

another of the same length upon the inner border of the sterno-mastoid muscle, making it fall upon the inner extremity of the first. He afterwards divided all the sternal portion, and a great part of the clavicular attachment of the same muscle, in order to turn it back outwards and upwards. After having separated with the handle of the scalpel, the jugular and subclavian veins and several small veins, together with the surrounding nerves, M. Mott laid bare the carotid; observing that it appeared diseased, he proceeded down to the brachio-cephalic trunk, around which he passed and tied a simple ligature of silk.

B.—M. Graefe proceeded nearly in the same manner, with this difference, however, that he left in the wound an artery compressor to tighten the knot, (*un serre-nœud-artère-presse.*) This, moreover, was the course that M. Porter thought proper to follow at Dublin in 1829, to tie the carotid very low down, in a man who recovered perfectly.

C.—Others have thought, I do not know for what reason, that we should succeed better by *trephining the sternum*; but the best process, and that which is performed with the most ease on the dead body, is the following, which differs, however, but very little from the method proposed by M. O'Connell of Liverpool, and which M. King has described in his Thesis.

D. *Combined Process of the author.*—I.—*First Stage.*—The operator being placed on the left, makes in the supra-sternal depression of the neck, an incision of about three inches upon the inner border of the *left* sterno-cleido-mastoid muscle, obliquely from without inward or from left to right; he thus divides successively the skin and sub-cutaneous tissue, the superficial layer of the *fascia cervicalis*, the adipose cellular tissue, and a second fibrous layer. Encountering behind, the sterno-thyroid muscle, the thyroid plexus, and the thyroid artery of Neubauer, when it exists, he separates these vessels or causes them to be pushed aside by an assistant; or even applies the ligature to them, if he cannot avoid them, and thus arrives at the trachea.

II. *Second Stage.*—Then are seen the left subclavian vein and the right internal jugular, which must be carefully turned aside to the right and upwards by means of the director. The surgeon causing his patient to bend his head a little, endeavours to identify the artery between the trachea and the right sterno-hyoid muscle; he first isolates its concave part, by inserting from before backwards, between it and the superior cava vein, the point of a slightly curved director; and isolates it in the same manner on the side of the trachea, in order to separate its posterior surface and to raise it up.

III. *Third Stage.*—Increasing a little the curve of the director, which serves to guide the ligature probe, whether he introduces it from before backwards, and from right to left, or from behind forwards, and from left to right, he takes care during all this manipulation to avoid tearing the pleura, or touching the nerve of the *par vagum*, which he leaves on the right, or drawing too much on the

subclavian vein, which perhaps, it would be more convenient on the living subject to raise up or depress, in order to pass the director between it and the trachea, than to push it aside (*que de la retirer*) as I have just mentioned.

IV.—This process, unquestionably, more simple and less dangerous than any other, has moreover, this advantage, that the same incision would admirably serve for either of the subclavians within the scaleni, or for either of the carotids near their origin.

V. *Consequences of the Operation.*—After the obliteration of the brachio-cephalic trunk, the blood is returned first by the ramifications and branches of the carotids and left subclavian, which pour it into the corresponding vessels on the left side; afterwards, these, that is, the thyroids, cervicals, &c., transmit it to the suprascapulary, external thoracics, acromial, common scapulary and circumflex, and consequently, to the whole upper limb, which also receives some through the medium of the intercostals and the internal mammary. Thus, it is not the want of circulation which we have most to fear, as a consequence of such an operation; but the section and the ulceration of the artery, rendered almost unavoidable by the proximity of the heart and the size of the vessel; and the effusions into the pleura, the inflammation of the aorta, of the pericardium, and even of the cavities of the heart.

VI.—On the supposition that the trunk of the innominate itself is diseased, no one would think of surrounding it with a ligature; the operation beyond the tumor, is then the only resource that can be attempted, and when the disease is confined to the carotid, however low down it may be, this last operation seems to suffice. Therefore, I see only two conditions that can make the ligature upon the brachio-cephalic trunk justifiable: 1, when an aneurismal tumor sufficiently developed to cover the secondary carotids up to their origin, nevertheless leaves space enough above the sternum to enable us to reach them, and that without being dilated, this trunk is diseased nearly up to the aorta; 2, when the subclavian alone being affected, the alteration of its coats extends too far toward its root to venture to surround it with a ligature, inasmuch as the method of Brasdor would then probably fail. The ligature then upon the trunk of the innominate, is an operation, in fact, which should rarely be put in practice, if in truth it is ever indispensable.

[ON ANEURISMS OF THE LARGE TRUNKS NEAR THE HEART.]

Dr. Peacock, (*Cormack's Lond. and Edinb. Month. Journ. of Med. Science*, October 1843, p. 871, &c.) after a series of experiments, fifteen in number, made with the intention of illustrating the mode of formation of dissecting aneurisms, and which consisted of injections into the aorta and its principal trunks, after securing their terminations by ligatures, and rupturing or not the two principal coats of the aorta, the vessels being all healthy, feels himself authorized to come to the following conclusions: 1st. That the coats of the

aorta in a healthy state, cannot be ruptured by the application of any ordinary force from within; which accords with the experiments of Dr. Davy, (Ib.) Such in fact, is the great strength of the internal coat, that the fibres of the middle or muscular coat split or give way transversely under the pressure of the finger from within, thus allowing the internal coat to protrude through the muscular, constituting a true *hernia* of the internal tunic, as corroborated by Laennec, Dubois, Dupuytren, and Liston. 2d. That when the internal coats are divided directly by an incision, or by a force acting from without, [meaning, doubtless, by a ligature, &c. T.] the fluid injected, readily penetrates between the middle and external coat, distends the latter for a great distance along the course of the vessel, and never forms a tumor bearing any resemblance to a circumscribed aneurism, and that this effect is equally produced, whether the aperture be of considerable extent or a mere puncture. 3d. That the external coat alone, does not in these cases possess sufficient power to resist permanently the pressure of the extravasated fluid, which, therefore, escapes into the adjacent texture, either by transudation or rupture. 4th. That when the middle coat is partially divided, its *different layers* admit of being separated by the current of fluid over a greater or less extent, but that the canal thus formed, tends rather to reopen into the original vessel, than to burst externally. 5th. That this separation between the laminæ of the middle coat is less readily effected than the diffusion of the fluid beneath the external coat; it being necessary, in order to accomplish that purpose, that the fissure should follow a transverse direction, so as to be opposed to the course of the injected fluid and that its edges should be separated, so that the current may bear directly on the outer laminæ. This separation does not take place so readily in the pulmonary artery as in the aorta, because the middle coat in the former, possesses [for a very obvious wise provision, as we think, from the immediate connection of this artery with the respiration T.] so much greater elasticity than that of the latter.

Therefore in most cases of dissecting aneurisms: 1st. The arterial tunics in various places present decided proofs of diseased lacerability. 2d. That the sac of the aneurism would be more likely to be situated between the laminæ of the middle tunic, than as has been usually supposed, in the space between the external and middle coats; which is, he says, corroborated by a recent case of Dr. Henderson, and by that of Drs. Pennock and Goddard in the American Journal of Medical Sciences. Dr. Peacock thinks that in a healthy artery it is only when the fissure between the laminæ of the middle coat, affords a direct opposition to the current, that a separation is effected; yet this has occurred without any extensive extravasation between the coats, in cases where the internal coats of the aorta have been ruptured during life.

Therefore, says Dr. Peacock, it is most probable that a dissecting aneurism can only take place in arteries, of which the coats are, as suggested by Dr. Henderson, rendered more readily separable by

disease, as when, to use the language of Dr. Henderson, "the outer coat with an adherent lamina of the middle, admitted of being detached with a facility not much less than that with which two moistened pieces of paper may be separated," (*Edinb. and Lond. Med. Jour.*, August, 1842.) In a case at the Edinburgh Infirmary, says Dr. Peacock, (*Loc. Cit.*, p. 878,) the coats were separated from the commencement of the abdominal aorta to the heart.

Difficulty of Diagnosis in Sub-sternal Aneurism. Aneurism of the Arch of the Aorta mistaken for Chronic Laryngitis.—No fact calls so imperatively for the grave attention of stethoscopists, or more significantly points out the utter impossibility of making those precise and minute diagnostic discriminations of the position, form and character of sub-sternal and thoracic aneurisms, and pulmonary disorganizations and degenerations than the one related with great candor by Dr. Janssens of Ostende, (See *Annales de la Société Medico-Chirurgicale de Bruges*, 1842; also *Jour. des Connaiss.*, de Paris, Mars, 1843, p. 116–117,) to wit: A seafaring man exceedingly robust and vigorous, aged 52, of irregular habits, on his return from a hot climate to reside in Europe, became subject to constant attacks of bronchitis with hoarseness, which finally obliged him, January 4, to enter the hospital at Ostende. The general health, and every function except those of the larynx, seemed to be normal. No pain or swelling in the neck, but more or less cough and abundant mucous expectoration. *There was however difficulty in the deglutition of solids immediately behind the upper part of the sternum.* Leeches to the neck, fumigations to the lungs, and every other medicament almost was had recourse to without any result. The patient returned to his occupation, went a voyage to the north, and soon came home much worse. He now had constantly a loud sharp shrill suffocating cough, continual dyspnoea and inability to lie down without strangling in some of these paroxysms. The expectorations became muco-sanguinolent. Upon the strength of, and especially guided, says Dr. Janssens, by M. Cruveilhier's pathognomonic sign of a hoarse stifled cough, &c., he diagnosed nothing else but *laryngitis*, and therefore freely cauterized the glottis with a solution of nitrate of silver. This and other means all proved useless, and the patient died, May 4 following, during a suffocating paroxysm, ending in coma. On *dissection*, the *larynx* was found *perfectly unaltered from the healthy state*; but in the posterior mediastinum was found a large aneurismal tumor, crowding on both lungs and the upper part of the trachea, and seated upon and communicating *with the arch of the aorta!* No mention is made of the stethoscope; but if it had been used as a means of interrogating the phenomena, would not the answer have been decidedly some *morbid alteration in the respiratory passages?* What but the slight difficulty of deglutition alone shadowed forth this terrible disorganization of the very foundations of the vital fabric?

Diagnosis of Aneurisms.—Professor Miller (See his late work on the Principles of Surgery, p. 439) furnishes some plain and use-

ful rules to be kept always in mind for the *diagnosis of aneurisms*: Thus, aneurisms are first soft and then solidify; abscesses on the contrary are generally first hard and then soften; whether abscesses (as lymphatic) are soft from the beginning or not, they want on pressure the *resiliency* of aneurisms; when a tumor (not aneurismal) over an artery is raised and held by the sides, its pulsations are faint or altogether absent; when these tumors are small they are separate from the artery and have no pulsation, but when large they become attached to it and thus receive its impulsions, but they never have those diffused expansive pulsations under the pressure of the hand, which aneurisms have, nor have they like aneurisms the thrill to the touch and bruit to the ear, both combined, but may have the bruit alone; in tumors over arteries the vessel, if it can be traced, will always be found free; while in aneurismal tumors it is the reverse.

Aneurism of the Pulmonary Artery.—Mr. Crowfoot of Beccles, (Eng.,) (at a meeting of the Royal Medical and Chirurgical Society of London, April 11, 1843, vide Cormack's Journal, Oct., 1843, p. 945,) describes the case of a medical gentleman aged 36, who, after repeated attacks of pulmonary disease, tending to symptoms of phthisis, finally died from successive attacks of hemoptysis. The upper part of the left lung was occupied by a cavity containing half a pound of grumous blood, which was traced to a small aperture in a dilatation of the left branch of the pulmonary artery nearly of the size of the aorta. Mr. Liston considered this ulceration, as in similar cases, to have resulted from pressure of matter contained in encysted abscesses—(Vide an extraordinary case of ulceration thus produced in the internal jugular vein, ending in death, under the head of *veins*, below in this present volume.)

Mr. Syme, in a communication to Mr. Liston, states that he had seen cases of hemorrhage from the ear and throat, which he considered as originating from some large vessel opening into an abscess—(See note on one of these cases below, under *veins*, and in which Mr. Syme found the hemorrhage to proceed from an abscess in the lateral sinus.)

Dr. Arnott related the case of a man in the Middlesex Hospital, in whom an abscess behind the angle of the jaw burst through the ear and neck and into the throat, with copious discharge of blood, ending in death. The cavity of a large abscess was found, and at the bottom of this a large opening into the facial artery just at its origin from the external carotid. He considered cases of this kind readily explicable by the isolated and unsupported state in which the parietes of the artery were left by the destructive and dissecting progress of an abscess.

Both Mr. Liston (Loc. Cit.) and Breschet (Ib.) relate each a case of an artery ulcerating and bursting into an abscess, and M. Cheyne (Loc. Cit., p. 946) one of a boy aged 6, in whom a suppuration of some large glands between the œsophagus and aorta was followed by perforation of the œsophagus, and finally by ulceration and perforation of the aorta close to the going off of the subclavian, ending

in effusion of blood into the œsophagus and stomach, which proved fatal.

Diagnosis of deep-seated Aneurismal Tumors.—M. Gendrin (*Revue Médicale de Paris*, for December, 1844. See also *Lond. Lancet*, May 17, 1845, p. 548, et seq.) adds the following diagnostic marks of deep-seated *aneurismal tumors* of the large arteries that may be examined, to those usually given: Each impulsion isochronous to the arterial diastole, is followed by a retraction of the tumor, easily appreciated by the hand, which retraction is accompanied by a tremor (*fremissement*) quite distinct from that which corresponds to the diastolic shock. In aneurisms of the large arteries, the retraction is nearly always followed and terminated by a second impulsive shock, which corresponds exactly to the systole of the artery. It consequently follows that on these tumors, two alternate shocks may be distinctly appreciated, the first of which corresponds to the diastole of the artery, and the second takes place between it and the following diastole. These double pulsations always exist in aneurisms of the large arterial trunks and are *pathognomonic*. Tumors receiving their impulsive motion from voluminous neighboring arteries present, he says, *only one impulsion isochronous with the arterial diastole*. Pressure beyond an aneurismal tumor (i. e., on the distal side) will shorten the pulsations, and give of course a greater shock to the hand, followed by an appreciable retraction. If the pulsations are double, the second *disappears* completely. These are best studied on the descending aorta by making pressure on the abdominal aorta.

The second impulsion sound to the stethoscope is always greater in proportion as the artery is larger—slight in middle sized and wanting in small aneurisms. In large aneurisms, the friction sound which usually follows the first impulsion sound, is sometimes absent, or if present often double. The friction sounds heard on stethoscoping the artery above and below the tumor, and which are isochronous with the arterial diastole, are the result, he thinks, of lesions in the tumor as they are fainter as we recede from it either way. The intensity and extent of the expansive pulsations and retractions of the tumor are modified by the size of its cavity, and by the stratified fibrinous clots within it. Hence the great differences of the extent and form of the impulsion, &c., in various aneurismal tumors and the same tumor at different epochs. The rugous filaments, fibrinous lamellæ, &c., often protruding from the margin of the orifice of the sac, greatly modify the sounds and sonorous vibrations. These produce the harsh friction sound, the tremulous sensations communicated by the tumor, &c., both in its retractions and expansions, thus prolonging the friction sound and sometimes also the tremulous motion which accompanies the retraction. If the arterial reaction is powerful, it drives back the blood which is returning from the more slowly contracting or retracting systole of the tumor, and hence the second shock; for the blood diffused into the large cavity of the tumor cannot return from it through its narrow orifice in time to be synchronous with the sys-

tole of the artery, and thus encounters the new impulsion of the artery. This second shock is more marked in aneurisms of the aorta and its first subdivisions, from the middle tunic above and below the tumor becoming hypertrophied.

With all this and other similar minute descriptions which have been given of the auscultic phenomena of aneurisms, we must confess that we see in M. Gendrin's rules as with others, when applied to latent aneurisms as those that are sub-sternal and thoracic, so much frittering and splitting up of distinctions, and such confused and contradictory subdivisions, as the double or quadruple percussion sound, the friction as well as the rugous sounds of the artery or the sac, or both, &c., all of which may be still rendered so much more obscure by displacements in the chest, co-existing destruction of the bones and other tissues, the presence of tumors within or disease of the heart and its valves, a varicose state of the large venous trunks from pressure of the sac, &c., &c., as we have elsewhere said that it leaves the whole subject at the present time in a state of almost as much mystification as ever.

Aneurism of the Brachio-Cephalic Trunk or Arteria Innominata.—M. P. E. V. Guettet, in a late thesis (*Determiner si l'on peut tenter la cure de l'anéurisme du Tronc Brachio-Céphalique, avec quelques chances de succès. La Ligature du Tronc Brachio-Céphalique, est-elle praticable?* Thèse supported, Dec. 31st, 1844, before the Faculty of Medicine of Paris. See Gaz. Méd. de Paris, Mai 3, 1845, tome XIII., p. 286, &c.) attempts to revive the now generally rejected method of Valsalva for the treatment of aneurisms, by applying it to those of the brachio-cephalic trunk, upon principles more minutely rigid as to regimen, rest, food and exercise, &c., than those adopted by the Italian surgeon. That debilitating and exhausting plan we may repeat *en passant*, is now generally considered obsolete and at war with the more sound pathological and physiological views which should govern the therapeutics of such affections. It has been well remarked by MM. Syme, Henderson, and others, that such an enervating and exsanguinating process by abundant bleedings, low refrigerating regimen diet, &c., must necessarily deprive the blood of its essential elements, and defeat the very object in view by depriving it of the power of furnishing the quantity of fibro-plastic lymph requisite to establish an adherent permanent clot in the sac; which verdict has been fully confirmed by the more or less opposite course of treatment adopted in the extraordinary cures by compression recently effected by the surgeons of Dublin, and by M. Liston and others who have imitated the process of the Irish practitioners. (See our note on *compression in the cure of aneurisms*, supra.)

M. Guettet, in sweeping terms, reiterates the perhaps too unmeasured denunciation or proscription which has been fulminated chiefly at Paris, against the method of Anel in aneurisms of the brachio-cephalic trunk, which question will be found fully considered and discussed in the *Remarks of Dr. Mott*, *infra*, whose opin-

ions, coming as they do from the first person that ever tied this trunk, may be thought to be entitled to some weight.

Nevertheless M. Guettet has furnished in his thesis some useful and original information of an anatomical character, to show why aneurisms in this trunk are so much more frequent than any where else except at the arch of the aorta. He lays it down as an axiom, from which we see no reason as yet to dissent, that in the *brachio-cephalic trunk, the impulsion of the column of blood (l'ondée sanguin )* has much greater force than in any other trunk in the supra-aortic system. Thus: so great is its width, and so little the curvature of the aorta from its root (origine) to the point where the innominate is given off, that a straight tube of six millimeters in diameter, being introduced into the aorta by one of its extremities, will pass in a direct straight line without any impediment into the orifice of the brachio-cephalic trunk. M. Guettet has also frequently passed a tube in this manner on the dead body, from the middle of the brachio-cephalic trunk to the sigmoid valves, and in two subjects to the bottom of the left ventricle without making any traction on the vessels. From which he concludes that much of the column of blood projected from the heart into the innominate, to wit, the central portion which corresponds to what in hydraulic tubes is called the thread of the current, (*le fil de l'eau*), or that which has the greatest velocity, (*le fil de plus grande vitesse*), must reach the latter vessel *directly and in a straight line, and without having undergone any [sensible] diminution of its momentum from the friction of the arterial walls*. In conforming also to another principle in hydraulics, this velocity in the column of blood in the innominate, must he remarks be still farther augmented by the fact that the united calibres of its two great bifurcating branches, the right subclavian and right carotid, greatly surpass that of the parent trunk. Thus he found on making their section that the area of the calibre of the innominate was 74.64 square millimeters, that of the right subclavian 60.03, and the right carotid 35.07. Thus the aggregate of the two last is 95.10, and that of the common trunk as above stated 74.64. Hence the impulsion of the blood is greater in the last than beyond its bifurcation. Again in the same subject he found that the sum of the areas of the left carotid and left subclavian was only 57.87—another cause of a predominant afflux of blood to the brachio-cephalic trunk. Hence, says he, the great frequency of aneurisms in the innominate, greater than any where else except at the arch of the aorta, because of the greater afflux and direct and uninterrupted impulsion of the blood from the heart upon this point;—and therefore according to the obliquity of the innominate to the aorta, this impulse and consequently the relative frequency of aneurism, will be either at its origin, middle portion, or distal extremity; which results, M. Guettet affirms, are conformable to the observations which have been made in practice.

In according, where a surgical operation should be resorted to, an unqualified preference to the method of *Brasdor* over that of *Auel*, M. Guettet proposes a new or retrograde revolution in the modifi-

cation to which the minds of the Brasdorean partisans seem now tending: to wit, he is not for tying both the subclavian and carotid, either simultaneously or at any time, but *only one* of these two trunks, as the most efficacious in the cure, and the most sound in principle. Thus, suppose for example, the inferior aortic orifice of the innominata is dilated to such extent by an aneurism as to receive more blood than the upper orifice can give egress to; then the innominata would become a sort of funnel with a wide mouth, whose walls will share in the pressure and distension which are experienced by the aorta, and will also be more exposed than any other part to the action of the sanguineous current coming from the heart. In consequence therefore of the relative narrowness of calibre of the upper extremity, the column of blood will exercise its greatest percussion upon the walls of this infundibulum; making the vessel in fact in itself a sort of *infundibuliform aneurism of the aorta*. These aneurisms therefore at the cardiac extremity of the innominata, would be aggravated by a ligature on the two branches, because the force of the impulsion would be vastly augmented by the total occlusion of the trunk, and lead to the inevitable destruction or expulsion of the clot.

But even the method of Brasdor must be abandoned where the aneurisinal dilatation is at the cardiac extremity of the innominata. If however, the dilatation is at the middle part, and one of the branches is tied and both its extremities through which the passage of the blood continues to be made, be supposed to be of like calibre, the actual median position of the aneurism between those narrow openings under such circumstances must favor the stagnation of the blood, and the deposit and formation of the clot.

Of the two branches he prefers, (and upon the presumed data we suppose, which we have just given,) the *carotid* to the subclavian; the ligature on this latter, after that on the carotid, having in his view hastened the death of the cases of Fearn and Wickham.

At the sitting of the Academy of Medicine of Paris, Sept. 8, 1840, the illustrious Larrey took occasion to give as his opinion, (*Gaz. Méd. de Paris*, No. 37, p. 589,) that the method of Brasdor should be totally rejected in any case whatever. M. Diday, in taking opposite ground and to illustrate the preference of this method in supra-clavicular aneurisms, indulges in a latitude of expression which is not wholly justified. He goes so far as to say, (See his memoir on this method, and on the ligature upon the Brachiocephalic trunk and the origin of its branches, *Gazette Médicale*, Feb. 22, 1815, p. 116, &c.,) that "if there is any principle in Operative Surgery established irrevocably, it is the absolute prohibition of a ligature on the arteria innominata for aneurisms of this artery," (See on this subject the general remarks of Dr. Mott on aneurisms, *infra*.) The resource by the method of Brasdor, M. Diday also deems perilous and uncertain, but the only one there is between the patient and certain death from the disease. And moreover, contrary to the opposite opinion of Mr. Wickham, an English surgeon, (*Gaz. Méd.* 1841, p. 365,) he deems this method more positively

indicated in the class of aneurisms of which this memoir above mentioned treats, than in those of any other region. He considers this method based on physiological principles that are incontrovertible, though not as easy of application as other methods. The little success however which has attended it shows, as M. Diday very properly remarks, that it requires revision and modification, (See remarks of Dr. Mott, *infra*.) M. Diday considers it impossible that any aneurism involving the brachio-cephalic can ever be radically cured except by the obliteration, either by surgical means or spontaneously, both of the subclavian and primitive carotid. At the time that the memoir of this surgeon first appeared, viz., in 1842, (Read before the Academy of Medicine of Paris, Sept. 13, 1842; but not published until in the *Gaz. Méd.*, Fév. 22, 1845, p. 115,) the method of Brasdor for aneurisms in the supra-clavicular space (*creux*) had been performed, he says, *seventeen* times, not one of which he contends militates against the truth of the foregoing proposition.

In addition to the *ten* cases only enumerated by M. P. H. Bérard, under the article Aneurism in his Dictionary, (t. III., p. 72,) M. Diday gives the following seven not contained in that work:—

1. That by M. Laugier, (*Bullet. de la Société Anat.*, 1835.)
2. M. Morrison, (*Gaz. Méd.*, 1837, p. 583.)
3. M. Dolhoft, (*Gaz. Méd.*, 1839, p. 57.)
4. M. Fearn, (*Gaz. Méd.*, 1838, p. 601, & 1839, p. 253.)
5. M. Colson, (*Gaz. Méd.*, 1840, p. 589.)
6. M. Wickham, (*Gaz. Méd.*, 1841, p. 365.)
7. M. Fergusson, (*Annal. de Chir.*, 1841, p. 484.)

Of these operations there were two only in which both the subclavian and primitive carotid were tied; but *not at the same time*, which M. Robert like most surgeons would consider too hazardous an attempt, and one that would almost render it impossible to re-establish the circulation in the right arm, (*Loc. Cit.*, *Gaz. Méd.*, Fév. 22, 1845, p. 116, and *Thèse de Concours: Des Anéurismes de la région sus-claviculaire*, by M. Robert, p. 122.) M. Diday however does not accord with M. Robert, in his apprehension of danger to the circulation of the limb. “If,” says M. Diday “after the ligature upon the trunk of the innominata itself, M. Mott and Graefe have seen nutrition maintained uninterruptedly in the arm for the space of 26 and 58 days, it is more than probable that the obliteration of its two branches, would not in this respect be attended with more serious consequences.” On the contrary might not M. Diday and others who believe in the practicability of the operation and the fair prospect of success which would attend it, on both the great trunks of the brachio-cephalic, on the principle of Brasdor, confidently maintain that this double interruption would in fact be far less hazardous to the circulation of the right arm, the neck, and entire thorax on that side, than the ligature on the innominata only?

By the report made by M. Blandin on the memoir of M. Diday at the time it was read to the academy (*Vid. sup.*) it appears, that that surgeon entirely accords with the views of the author as to the

propriety of the ligature both upon the subclavian and carotid. Mr. Liston, in fact, at London in July 18, 1838, (See *Gaz. Méd.*, 1838, p. 600,) tied both at the same operation and the man died on the 30th day from secondary hemorrhage.

M. Diday and most other surgeons would scarcely think it prudent to tie, unless under very peculiar circumstances as stated by Dr. Mott, (see *infra*,) both arteries at one operation.

The subclavian, according to M. Diday, should be tied as near the tumor as possible; because, in proportion as the ligature should be more remote, the greater, naturally, would be the number of, and the greater certainly the chance of obliterating, branches that might be given off in this interval between the ligature and tumor; and therefore to the same extent would there be more danger of producing mortification of the arm, the more the collateral circulation would be deprived of the branches which were gradually to re-establish the course of the blood between the branches of the right subclavian and those of the left carotid and left subclavian. [See Dr. Mott's remarks below, wherein it will be seen that he entertains an opinion the reverse of that of M. Diday, as respects the point on the subclavian to be selected for a ligature.]

Although the surgeon, says M. Diday, might feel greater confidence of success if he found one of the two great branches of the innominate already spontaneously obliterated to his hands, and might therefore suppose that the ligature on the other would certainly complete the cure; yet that this is not always so; for it has been found (in proof of which he gives the cases of MM. Wardrop, Mott and Wickham) that the operation of the ligature then is to have in some cases the disastrous effect of re-opening a large passage for the blood through the interior of the sac, and thus to give a new impulse and greater activity to the disease, showing that the obliteration which had been supposed to be permanent was only temporary. In the examples cited, M. Diday appears to have supposed that the operators labored under a misconception of this kind.

Surgeons, therefore, should not, according M. Diday, to conclude, because no pulsation may be felt in the carotid for example, that that artery is obliterated. We believe there are none professing any knowledge of the subject who have ever allowed themselves to be deceived by any such illusion. Suppose in such a case this cessation of pulsation in the carotid had been owing, as he thinks it might be, to the size and pressure of the aneurismal sac itself upon the artery, this latter, on tying the subclavian would immediately diminish and the blood return to the carotid.

Thus, also, in the case above cited of Mr. Wickham, (*Loc. Cit.*, *supra*,) the carotid was tied first and the tumor diminished, but then augmented in volume and prolonged itself in a new direction outwardly and along the clavicle, because, no doubt, according to M. Diday, the pressure of the tumor being at first taken off from the subclavian as we are to suppose, the latter vessel was as it were re-opened, and in this manner gave vent to the then pent-up

blood of the aneurism and actually augmented its volume—all of which reasoning, as it appears to us, is somewhat contradictory upon the principle laid down by M. Diday that the augmentation of the volume or size of the sac has just produced a temporary suspension of the pulsation, i. e., an apparent obliteration of the calibre of the carotid or subclavian.

Notwithstanding which obscurity, M. Diday thinks we may overcome the difficulty of the diagnosis on this point of permanent or temporary obliteration by attending to the following rules:—

1. To ascertain if the vessel in question corresponds at its origin or at its middle portion only, to the most prominent point (point le plus saillant) of the aneurismal tumor; in the first case there would be more probability of obliteration; in the second, of compression.

2. To ascertain if the movements made in the shoulder, arm and head do not cause some pulsation in the branches of one of the two trunks in question—thus in the radials or temporals for example.

3. To ascertain if these same pulsations may not be made to reappear, by displacing the aneurismal tumor with the fingers, and endeavoring to shift it (*la détourner*) from off the arterial trunk which we may suppose to be compressed by it.

4. To mark the dilatation which is sometimes noticed in the veins contiguous to the tumor; we may, from this sign, conclude that the tumor presses forcibly on the neighboring parts, which will be an additional reason for supposing that the cessation of the pulsations in one of the arterial trunks is attributable only to the pressure made upon it at its origin.

M. Diday considers it a law, positive and incontrovertible, that whenever one of the two great trunks of the innominata is either totally obliterated or has undergone an organic contraction (or diminution) in its calibre, the ligature must first be applied to the other trunk.

Among the minor points which become enhanced in importance where both trunks are found permeable, are:—the direction of the great axis of the tumor, and that in which it appears to make the most rapid progress; that in which its pulsations act with the greatest force, and the changes produced in the size of the sac by making alternate compression upon one or the other of the two trunks in question; all of which may be of service in determining the surgeon upon which artery he should first apply the ligature.

The last test is the best, but not decisive, for in a case in which Wardrop (*Thèse de Villardebo*; 3e série, 1 observ.) found compression on the subclavian produced no change in the tumor, he nevertheless tied that vessel, and found that immediately after the operation the size and pulsations of the sac disappeared; and the respiration became more free. So in the case of M. Morrison, (*Gaz. Méd.*, 1837, p. 583,) the tumor did not sensibly diminish in volume, though pressure was made with great force upon the carotid; yet he tied this vessel and the tumor disappeared entirely, so that the patient continued well for more than *sixteen months*.

Where there are no indications to guide us it is best, M. Diday thinks, to commence with the ligature upon the carotid. He considers Wardrop to have established the fact that the constriction of this vessel diminishes to a much greater degree the blood which traverses the sac than that of the subclavian possibly can do. So, also, are the dangers of the operation incomparably less; on which account, doubtless, it is that all the surgeons who have tied the two branches have begun with the carotid. The statistical results also fully confirm the correctness of this decision.

Up to the present time, surgeons have not proceeded to a ligature on the remaining trunk, until that on the other has been found to have failed in effecting a cure. Though it is an established truth, that whatever branch has been tied, the sac has, *without a single exception*, says M. Diday, experienced a certain diminution in its volume and pulsations, yet a preference has perhaps been given to the ligature on the carotid first, from the *impossibility of distinguishing with certainty* an aneurism of the innominate from one at the origin of the carotid. This has led to the hope of a cure by tying this artery only, and thus, by procrastinating the period of tying the subclavian, the aneurismal tumor has been permitted to obtain a new growth. To this circumstance M. Diday imputes many of the failures.

The second operation should be performed, he thinks, as soon as it is ascertained that the tumor no longer decreases, and especially if the pulsations which have been temporarily suspended by the first operation, begin to reappear. Thus, in the case of M. Wickham, (Loc. Cit.,) the tumor, by the ligature on the carotid, had at first diminished; but, at the *end of a month*, it had acquired its primitive volume. The patient resisted the operation on the subclavian for another month, when the tumor having now acquired an enormous size, the ligature on this vessel resulted soon after in rupture of the sac and death. One motive for retarding the second operation, should that be on the subclavian, undoubtedly has been the fear that the circulation might not be re-established in that vessel, because of the anastomosing branches to it from the carotid being now cut off. This M. Diday thinks an inadequate reason for delay; moreover, it is possible, he thinks, to establish, by the pulsations in the temporal and facial arteries, and even by those of the tumor, that the circulation of the carotid is restored, and therefore that there is no danger in proceeding to the subclavian. Montgomery has seen the pulsations of the temporal and facial arteries reappear in ten days after a ligature on the carotid. *Until the second ligature is decided upon, gentle and moderate compression should be made on the sac.* This we think one of the most important suggestions of the author, especially after the remarkable success which has resulted at Dublin from treating aneurisms by compressing moderately the trunk of the vessel above the sac; (see note on the subject above;) also, by *direct pressure* upon the sac itself, (see Mr. Luke's case, note above.) Could compression to the tumor and its neighboring connecting trunks be efficiently ap-

plied, and conjointly with a ligature on one of the great branches, so as to effect a cure, it would indeed be another masterly and bloodless triumph for surgery. This compression, says M. Diday, in the interval mentioned, would become indispensable where it is the size of the sac whose pressure has suspended the pulsations in a neighboring artery. We thus, in taking off the pressure on the artery and applying it to the sac, aid its natural contraction.

In regard to the place to be selected for a ligature, it is to be remarked that all the hemorrhages which have followed the ligature on the carotid by the method of Brasdor, have come from the upper, i. e., the *peripheric* end of the vessel, in both the cases published, viz., that of Lambert and that of Montgomery, (Vilardebo, ut sup.) M. Diday considers that such hemorrhages are owing to surgeons not paying sufficient attention to a point of surgical anatomy which he deems of great importance, viz.: to tie the trunk at a sufficient distance above a collateral, provided that collateral be of large size, and goes off in a retrograde direction from, and at an acute angle with, the main trunk, i. e., has its sinus (sinus) turned towards the capillaries, (sous un angle aigu à sinus tourné vers les capillaires;) for, in that case, the column of contained blood in the collateral, though diminished by passing through the capillary, circulation may still have so much force as to break up the clot above the ligature. To this cause, viz., an ulceration of the peripheric end of the artery, he imputes the hemorrhage which proved fatal to Dr. Mott's case of ligature on the innominate, 1818, and that of M. Crampton on the primitive iliac, 1828. He cites also a case he saw at the Hospital of Saint Louis, Paris, in 1839, in which fatal hemorrhages supervened from the lower end, in a patient in whom the femoral had been tied a little above the origin of the profunda, (*Gaz. Méd.*, 1839, p. 681.)

M. Diday considers that all these conditions of hemorrhage from the periphric extremity, exist to a greater degree in the primitive carotid than elsewhere, to wit, the proximity, size, and retrograde direction (la direction retrograde) of the collaterals; for, in the only two cases where hemorrhage took place in this vessel from the peripheric end, the ligature was placed too high up on the artery; thus diminishing not only the length of the contained clot, but its power of resistance to the reflux current of blood. Thus Montgomery, in his case, remarks that the ligature was placed very near the bifurcation of the carotid. In that of Lambert, he states that the ligature was placed above the point where the artery is crossed by the omo-hyoid muscle.

Therefore, says M. Diday, tie the carotid as far as possible from its bifurcation; only that, in thus approximating nearer to the tumor, we run the greater risk of constricting a diseased portion of the vessel. Prudence and judgment must decide upon the *juste milieu*, though M. Diday would, in a case of doubt, prefer approaching the tumor than the capillaries. He instances the great number of cures and infrequency of hemorrhages in the ligature on the external iliac for spontaneous aneurisms, and in which it has to be

placed very near the tumor. The danger, therefore, of this method, which was that of Kesleyre, he thinks, has been greatly exaggerated by Jno. Hunter.

At the bifurcation of the carotid, there is, according to Hodgson, the additional danger that depots of calcareous matter and simple dilatation are more common here than in any other part of its trunk.

M. Diday furnishes the following interesting table of the number of cases in which the method of Brasdor has been applied to aneurisms of the innominata, or the origins of its branches. As his memoir was read to the Academy, Sept. 13th, 1842, but not published in the Gazette Médicale of Paris until Feb. 22, 1845; it may be safely asserted, I think, that there had not come to his knowledge, (as there has not to ours,) up to the time of its publication, (1845, Feb. 22,) any additional case to the *seventeen* which he enumerates. He considers the case of M. Rossi too exceptional to be added to his list. We think it, however, one of the most important, as establishing the remarkable fact that the functions of the brain were sustained for *six days* by the *right vertebral artery alone*. The more recent operation of Dr. Campbell we shall also add, as illustrative of the diagnosis, the operation, and its accidents; though not strictly belonging to this table, inasmuch as the whole trunk of the aorta was involved in aneurismal disease, as well as the innominata itself. It is too instructive, however, in its bearings on the innominata, to be omitted. This makes, up to the present time, *nineteen* cases in all.

We have given a more detailed abrégé of the useful paper of M. Diday, because of its historical details on most of the operations which have been performed on the brachio-cephalic trunks for aneurisms, by the method of Brasdor. This method has of late years attracted much attention on the Continent, and M. Diday, a zealous champion of it, has, as we should think, exerted himself with all the ability that could be brought to bear in its favor. Consequently, it will be seen that his analyses of several of the fatal cases are made to correspond in favor of his views. We (speaking for ourselves individually) are no partisans of the Brasdor plan; least of all, in giving it a preference over that of Anel, where that is at all practicable. The paper of M. Diday will be serviceable, at least, as a reference for those who are investigating this subject, and wish to treat it with exactitude, as always should be our rule in all matters of science.

Table of the NINETEEN OPERATIONS performed up to the year 1845, inclusive, on the *Distal* method, or that of Brasdor, for aneurisms of the *Arteria Innominata*, and of the origins of its trunks.

No. of Cases.	Not operated.	Cures.	Deaths, &c.		
Nineteen.	The patient of the 3d observation of Wardrop, where the autopsy showed that the ligature had not been placed upon the carotid.	The patient operated upon by Wardrop as mentioned in his third observation. That of Busch. That of Evans. That of Colson.	By hemorrhages attributable to the operation.	By continuance or return of the disease.	By other causes; pleurisy, pneumonia, pericarditis, or causes not specified.
			The case operated upon by Lambert. That of Dupuytren.	The third case operated upon by Wardrop. That of Morrison. That of Mott. That of Wickham.	The case operated upon by Key. That of Dolhoff. That of Fergusson. That off. Fearn. That of Laugier. That of Montgomery.
			2	4	6
			12		
			Add case of Rossi 1 (see infra.) " " Campbell 1 (see infra.)		
Total 19.	1	4	14		

Of the twelve cases of deaths given by M. Diday, he supposes that the following *six* may possibly be attributed to the operation:—

1. That of M. Key, dead at the expiration of two hours,
2. " " Fergusson, " " " eighth day,
3. " " Dupuytren, " " " ninth day,
4. " " Dolhoff, " " " a few days,
5. " " Laugier, " " " thirtieth day,
6. " " Lambert of Walworth, " " " sixth week,

from hemorrhages.

He then gives the remaining *six* cases of deaths, in all of which the patient, having survived for four months or more, the fatal termination cannot, in the opinion of M. Diday, be justly imputed to the operation:—

1. That of Montgomery.—The patient lived until the expiration of four months after the operation, and appeared to have been perfectly cured.

2. That of Mott.—Dead from a return of disease eight months after the operation. The recovery on the 30th day after the operation, appeared to be so perfect that there was a complete subsidence of the tumor and cessation of the pulsations.
3. That of Wardrop, (his 3d observation.)—The tumor having entirely disappeared at the expiration of a year after the operation, returned after the 27th month, and proved fatal.
4. That of Morrison.—The patient appeared perfectly cured, and came repeatedly to visit his surgeon to express his gratitude, but died 20 months after the operation.
5. That of Fearn.—The patient survived, and seemed to be doing well for 27 months after the first ligature, and then died, apparently from pleurisy.
6. That of Wickham.—The patient lived for five months after the first ligature.

These *six* cases, as M. Diday remarks, establish the important fact that the patient in each, counting them in the aggregate, survived, it may be said, for the period of *fourteen months and twenty-seven days*. In several, the aneurismal tumor had entirely disappeared, and the cure was, to all appearance, complete. The operation in all the six cases cannot be considered as having been injurious, but, on the contrary, to have prolonged the life of the patient to a certain extent of time. If we add that of Lambert, it would make seven; and in this case, though the patient died at the expiration of the seventh week, it was, according to M. Bérard, (*Dictionnaire*, tom. III., art. cité, p. 63,) unquestionably one which is to be ranked among the cases of cure, for dissection proved that the lower portion of the carotid, as well as the aneurismal sac, had become obliterated and impermeable.

From comparing these two orders of facts, says M. Diday, the conclusion is irresistible, that so often as the ligature applied according to the method of Brasdor, for aneurisms of the supra-clavicular space, has not been followed by accidents that have endangered the life of the patient, its effect upon the progress of the aneurism has been favorable; or in other words, *as often as it has succeeded as a surgical operation, it has equally succeeded, though in different degrees, as a curative means!*

This conclusion should, M. Diday thinks, give encouragement to surgeons to make new trials of this method which, in his opinion, has been unjustly proscribed by many as too dangerous or as insufficient. For, wherever time sufficient has elapsed to enable it to produce its effects, these have been either:—1. *always* favorable; or, 2, *very often* sufficient to cause the disappearance of the aneurismal tumor. These last-mentioned cases amount to as many

as *ten* out of *sixteen*. This is the number of cures, temporary or complete; if, on the one hand, we add to the four cases of cures, those of Montgomery, Fearn, Mott, Wardrop, (3d observation,) Lambert and Morrison, in which, notwithstanding their ulterior fatal termination, the primitive aneurism had been cured by the operation; and, on the other subtract from the whole number of seventeen cases, the second observation of Wardrop, where no ligature, in fact, was applied.

Distal Operation for Aneurism of the Innominata.—It is stated with, however, scarcely any of the details, (*Journal des Connaiss.*, &c., Paris, Fév, 1844, p. 78—79,) that M. Rossi, of Italy, has performed for aneurism of the innominata, a distal operation on both the subclavian and primitive carotid, placing the ligature on the first, above the clavicle, outside the scalenus. The patient lived only *six* days. The left carotid and left vertebral were, however, found to be obliterated. Consequently, the cerebral functions must, during the six days, have been sustained by the left *vertebral* artery alone.

The *distal operation* for diagnosed *aneurism of the arteria innominata*, was performed, in England, by Dr. Geo. W. Campbell, by ligature on the right common carotid, March 8th, 1845, on a patient named John Smith, many years in the dragoon service, aged 48 years, and of robust health, but for a number of past years intemperate. It was caused, as he stated, about the beginning of the month of February previous, by sudden violent exertion in splitting wood, showing itself immediately in a small sub-cutaneous, moveable, pulsating, and apparently isolated tumor about the size of a marble, which could be freely rolled about under the skin, and which was situated directly above the sterno-clavicular articulation. It grew rapidly. He had for years severe pain occasionally in the right shoulder, and side of the neck and head. The tumor, when first seen by Dr. Campbell, Feb. 22d, 1845, was about the size of a large egg, was visible both on the tracheal and external margin of the sterno-cleido-mastoid muscle, measuring $3\frac{1}{4}$ inches in its longest diameter, which was transverse to the axis of the neck, and extending vertically above the sternum and clavicle for $2\frac{1}{2}$ inches; it could be followed into the chest, and was felt pulsating as low as the junction of the cartilage of the second rib with the sternum. The tumor was capable of being almost entirely dispersed by compression, the pulsation being equable all over its surface, apparently increasing in proportion to the pressure employed, at each impulse strongly elevating the fingers, and whenever the pressure was removed, instantly regaining its original dimensions. Upon firmly compressing the carotid artery of the right side against the transverse processes of the cervical vertebra, the *pulsation* in the tumor was *arrested*, and it became soft and flaccid. A similar effect was produced, but not in so marked a degree, by compressing the subclavian over the first rib. The pulse was equally good at the wrist, and in the branches of the carotid on either side. On percussing the chest, the inner portion of the

right sub-clavicular region was found to sound dull, and upon the application of the stethoscope, a distinct pulsation was discovered in that situation, gradually losing its intensity as the heart was approached. This pulsation gave a strong impulse, was double, was not attended by any thrill, and by only a very slight bruit de soufflet; it might be compared to a heart beating very strongly at the top of, and to the right side of, the sternum. Neither bruit nor thrill was discoverable in the tumor above the clavicle.

In consultation with his friends the surgeon found a pretty unanimous opinion that the disease was an aneurism of the arteria innominata, justifying an operation. Low diet and digitalis for a fortnight reduced the patient much; notwithstanding which the tumor had in the interval slowly increased in bulk and its parietes both external and internal to the sterno-mastoid muscle become very thin—so that no hope was left but by an operation, which might give the patient a chance for cure. Accordingly the distal operation, and upon the common carotid, was decided upon. A single silk ligature was applied to the carotid trunk on a portion ascertained to be perfectly sound, and the same secured by a double knot, leaving but one extremity. Immediately on tightening the ligature, the aneurismal swelling completely disappeared, and no trace of it could be discovered for several minutes; after a short time however, it began gradually to return, but it did not nearly regain its original size, measuring only two inches in the transverse diameter, and rising little more than an inch above the sternum; the pulsation was by no means so strong, and the tumor was much softer and more compressible than formerly. The pulse before the operation was 96, during the operation it sank to 88, and became very small; immediately afterwards it again rose to 96. Immediately upon tightening the ligature, the patient complained of severe pain in the side of the head; the pupil of the opposite eye became slightly dilated, he felt for a few moments bewildered and confused, and could with difficulty be induced to remain quiet. At three hours after the operation, the pulse rose to 120, accompanied with a teasing cough and pain in the head as before. Venesection, purgatives, and other emollient means allayed the febrile reaction, cough, hoarseness, and other symptoms, and the patient became comfortable. On March 11, the wound was dressed and the stitches removed; primary union had taken place in the lower half of the incision—the upper half discharging, but healthy. The tumor was diminished to the size of a *walnut*, very compressible, and pulsating by no means strongly. The compress was reapplied over it. Febrile symptoms supervened the 12th, were allayed by venesection and treatment as before, with a small quantity of tincture of hyoseyamus, and on March 13th, the patient became quite comfortable—pulse 90 and soft, cough gone and had slept well. March 14, wound again dressed, looked healthy and was all healed except a small portion at the upper part which was discharging healthy pus. Tumor same as at last dressing, and still soft and compressible. Treatment continued. March 22d, all the favorable symptoms

continue to a surprising degree—wound nearly cicatrized—ligature still firm—tumor quite flat, and can only be discovered by a slight pulsation, which still exists at the inferior and external part of its former situation. Pulse returned to temporal artery on the right side—pupil of the left eye still slightly dilated—pulsation at the upper part of the sternum much diminished in impulse—functions all natural. The compress upon the tumor was discontinued, and the digitalis and restricted diet persevered in. March 23d, the surgeon was called for suddenly, at about two in the morning, and found the patient had on the preceding evening left his bed for the first time, and been sitting by the stove without any covering—which brought on a rigor soon followed by a high fever and intense headache, from which he had suffered all the previous night. He was now slightly delirious, with hurried respiration and pulse at 140—the heart's action tumultuous, and so strong as to shake his whole body and the bed on which he lay. Venesection was again performed, but as on the two previous occasions, though only to about 14 ounces, gave with cathartic measures great relief. Patient complained of a sense of *suffocation*, and cough, made 28 respirations in the minute, with the pulse still 130, though soft, and voice husky. March 24th, patient greatly better—pulse 120—mind clear—bowels open—cough not troublesome, and no suffocation. On examining the chest, a dull sound on percussion was found to extend over a much greater portion of the right sub-clavicular region *than formerly*, and a *pulsating* tumor could be felt with the fingers, extending from the cartilage of the third rib to the clavicle. Upon applying the stethoscope no bruit was discoverable, but impulse very strong and sound double; a loud bronchial ronchus was heard upon the right side during inspiration; the point at which it was most distinctly heard was *posteriorly*, and internal to the scapula; it was at the time attributed to compression of the right branch of the trachea by the aneurism—no return of the tumor in the neck. The patient however, continued to improve, and on March 26, was reported much better—pulse 100, soft—skin and tongue moist—respiration natural—cough not troublesome—requested to eat—stethoscopic signs nearly as before.

March 27. Again suddenly sent for in the night to the patient, the surgeon found him sitting up in bed suffering from great dyspnœa, countenance livid—pulse 150 and very small—heart's action exceedingly tumultuous—left pupil largely dilated; *two pulsating* tumors were felt *rising up upon both sides of the sternum*, the larger one upon the right side, *in the situation of the original aneurism*. These tumors were not well defined, as the whole neck was swollen and of a livid color, from venous engorgement. The distressing sense of suffocation continued, and he expired at 5 P. M., on the same day, perfectly sensible to the last, and conscious that he was dying from the first seizure.

Post-mortem fifteen hours after death. The surface of the upper part of the chest, neck, and face, presented a livid appearance, from venous engorgement. Upon opening the thorax, a large tumor

was discovered, resembling very much in size and appearance, the heart enclosed in the pericardium, occupying the superior portion of the right side of the chest, and extending towards the left side, half an inch beyond the centre of the first bone of the sternum. The tumor filled up the whole of the anterior and middle mediastinum, above and in front of the root of the right lung, extending from the cartilage of the third rib to the top of the sternum. The left ventricle of the heart was slightly hypertrophied; the aortic valves were free from disease, the ascending aorta was greatly dilated, and numerous *scales of bone* were found deposited in and under its lining membrane. The aneurismal swelling commenced at the root of the arteria innominata, involving the whole of the anterior parietes of that vessel, to within a quarter of an inch of its bifurcation, and also, the *transverse portion of the arch of the aorta, as far as the giving off of the left carotid*, the origin of which was slightly dilated. The first bone of the sternum, the sternal ends of the clavicle and first rib, were denuded of periosteum, [i. e., we presume of course on the right side. T.] and formed *part of the anterior wall of the aneurismal sac*, the first bone of the sternum being *deeply hollowed out* by the pressure of the contained blood. From the superior part of the large tumor, the remains of *two smaller aneurisms* were found arising; the posterior one, the larger, extended *into the neck* upwards, and towards the right side, for at least a couple of inches above the clavicle; its sac in front was composed of the deep *cervical fascia, and external and internal to the mastoid muscle*, was exceedingly thin and weak. The sac of the anterior aneurism was capable of containing a small walnut; it arose from the large sac about the centre of the sternum, by a distinct opening immediately in front of that into the posterior aneurism; the sacs of both these aneurisms were found empty and collapsed. The interior of the large aneurism was almost completely filled by a large coagulum, weighing *eight ounces and a quarter* avoirdupois, very dense in structure, not deep in color, formed of distinct lamellæ, and in many places *slightly adherent* to the parietes of the sac. A loose coagulum of blood very different in appearance and structure from the fibrinous mass occupying the interior of the aneurism, was found in the ascending aorta. The descending aorta was dilated as far as the diaphragm, and contained ossific deposits in its interior. The right carotid was found nearly divided by ulcerative absorption, produced by the ligature, half an inch below its division; the vessel was plugged up by a *firm coagulum*, for upwards of two inches below the ligature; the superior part was also *filled up in a similar manner*, as far as its bifurcation. The superior part of the right lung was found condensed in its substance, from the pressure of the tumor. The left lung was congested throughout, and posteriorly and inferiorly was found in the first stage of pneumonia. The liver was larger and harder than natural; the other abdominal viscera were healthy. The brain was found quite healthy; and the branches of the internal carotids seemed equally large on both sides (*British-American Journal of Medical and Physical Science*, No. I., April, 1845.

Also Cormack's *London and Edinburgh Monthly Journal of Medical Science*, June, 1845, pp. 454, 455, 456, 457, 458.)

Remarks. This case is given at much length above, because the data on this interesting subject of the most formidable kind of aneurismal tumors upon which surgery has ventured to proffer its resources, are lamentably defective in many of the cases for which the ligature is now said to have been applied since the first and cardinal operation performed by Dr. Mott on the trunk of the arteria innominata itself. Here we have in addition to a tolerably faithful narrative of the phenomena antecedent and subsequent to the distal operation performed on the common carotid, the far more valuable part of the testimony which lies in the post-mortem structural changes.

It is clear that but little or no dependence is to be placed upon the vanuted interpretations of auscultation or the stethoscope, and that simple percussion and the ear to the chest are doubtless the least fallacious of those diagnostic means, but which at best can give but a faint general outline, as it were, of the character of the organic disease in those situations, and the revelations of which probably are far less to be depended upon than those from the eye and touch, and an exact and profound knowledge of the anatomical and surgical relations of the regions interested.

Thus of the principal tumor, the modifications of sound caused by the attenuated sternum and subjacent condensed lung, and the general character and relative position of the altered organs, auscultation it appears gave no indication worthy to be named, but, as it proved, led to a miserable delusion, to say nothing of the total ignorance in which it left the explorers in all that related to the extensive aneurismal dilatation of the aorta itself down to the diaphragm and up to the left carotid, and of the boney deposits it contained, all of which organic changes of this great trunk must have been of long standing, as also the actual aneurismal sac of the innominata itself, and its two *pulsulating* aneurismal pouches, the whole the result doubtless of a chronic degeneration of the parts and morbid constitutional diathesis involving at least all the main and principal great trunks of the sanguineous circulation and the heart itself. In fact the truth is now well established, and was or might have been long since predicted, that no auscultatory or acoustic means can even probably disclose to us the never-ending, ever-varying complexity and obscurity of relations, as those of form, position, size, density, &c., which morbid causes will ever constantly produce in the great vital organs of respiration, circulation, &c., contained within the thorax, much less in regions of soft parts where there are no firm or solid hollow boney cavities or structures to give as the thorax does ample resonance of every kind of intimation from air or blood vessels or sacs to aid in the investigations made by stethoscopic processes.

Had less reliance been placed upon such processes the operation probably would not have been attempted; for where there could be reason to suppose, and the complex and organized condition of

the sac and its accompaniments and the condition of the aorta favor this opinion, that the disease had been of long standing, the result probably of constant distension of the heart and its trunks from spirituous potations, the distal side of the tumor at least was but a hopeless reliance at best, though the only one offered. As it has resulted, it may serve to show that the distal operation, as the first suggestions of common sense as to the effects of regurgitation upon the larger trunks near the heart would lead us to suppose, will, in fact, or at least may aggravate the disease and accelerate the fatal issue. How much, in truth, of the aortic dilatations and the refilling of all the sacs towards the close of life may not have been owing to the selection of the distal side of the tumor? Still the flaccid, empty condition of the two small sacs and the mass of solid fibrine occupying and almost adherent to the parent sac, would seem to show at least that a blow was struck, and that nature had responded with her recuperative energies. But for such enormous structural degeneration what possible hope of success could there be for a therapeutic power so feeble and inadequate as the mere ligature on the common carotid—when at best such ligature in such cases of vast organic changes must, as we think, necessarily add to the amount of mischief? It is barely possible to suppose that where the resistance opposed by the distal operation and the limitations of diseased structure and the force of recuperative energies at the proper time of life, are all in equilibrium, that a permanent clogging up or consolidation of the sac or sacs, and a permanent and radical cure would result. Otherwise not. We recur back then after all that Wardrop and others have done to generalize the distal mode of Brasdor to our own preference to the original suggestions made by Anel, and which were first attempted on the *arteria innominata* upon the cardiac side of the aneurismal tumor by Dr. Mott. When it cannot be employed for the *innominata*, the case should be abandoned, and if the unvarying, untoward and fatal result for the cardiac operation also, beginning with that of Dr. Mott, and coming down to the present time, are to be taken into account, it is doubtful, without some new light should be thrown upon the treatment of aneurisms in this trunk, whether either mode should ever be repeated. Dr. Mott, however, cannot, without reluctance, deny himself the hope that the day may come when surgery will yet triumph over the difficulties almost insurmountable that here seem to lie in her path.

M. Malgaigne (*Manuel de Méd. Opérat.*, Paris, 4th ed., p. 183) gives the preference to the process of Dr. Mott if a ligature is to be attempted on the *arteria innominata*, but he fears it will never succeed, except perhaps by uniting *mâchures* to the ligature, (par l'adjonction des mâchures à la ligature.)

Mr. Liston (See his Lectures, London Lancet, Dec. 7, 1844, p. 307) states that he had tied both the subclavian and carotid in *two cases*, (recently we are led to infer,) for aneurism of the subclavian within the scalenus muscle. The method of Brasdor did not, in these instances, succeed, as both patients died of secondary hemorrhage. "The vessel had closed, he says, (meaning, we presume, the

subclavian,) next the heart, and the bleeding had been all from the recurrent vessels. "This is a proceeding," he adds, which, looking at the result of these cases, I should scarcely have recourse to again. It is the only chance the patient has, but still the chance is so slight, that I do not think the surgeon is warranted in performing the operation. I do not think that anything could induce me to have recourse to the operation on the innominate or even to this modified operation." He states the anatomical difficulties which are well known. He used the L incision, i. e., one branch from the sternal extremity of the clavicle along the inner border of the sterno-mastoid muscle, the other along the upper edge of the clavicle, the flap made by which branches was turned back.

Simultaneous Ligature on the Subclavian and Carotid for Aneurism of the Innominate.—M. Guérin, noticing (See his *Gaz. Méd. de Paris*, t. XII., 1844, p. 58) the simultaneous ligature on the right subclavian and primitive carotid for aneurism of the innominate, as performed by M. Rossi, (See *Bulletino delle Scienze Mediche*, for July, Aug. and Sept., 1843,) states that this and the case of Mr. Liston are the only ones in which the ligature has been thus applied at the same operation.

M. Rossi tied the subclavian above the clavicle outside the scalenus, by the method of Brasdor. The left carotid and right vertebral arteries were both found obliterated. T.]

ARTICLE X.—ARTERIES OF THE THIRD OR FOURTH ORDER, WHICH MAY ALSO REQUIRE THE AID OF SURGERY.

Some arteries, which have not yet been spoken of, may nevertheless become the seat of aneurisms, and require the aid of operative surgery, when they are wounded.

§ I.

The arteries of the shoulder and those of the thorax have chiefly attracted attention under this point of view. A fact taken from the practice of Desault is related, where it appears that this surgeon, supposing that he was opening an abscess, plunged the bistoury into an aneurism of the thoracic arteries. Pelletan (*Cliniq. Chir.*, t. II., p. 10) says he saw, on the apex of the shoulder, a tumor which he took for an aneurism of the acromial artery. M. Liston (*Edinburgh Med. & Surg. Journ.*, vol. XVI., p. 66) speaks of a bloody sac whose walls were ossified, and which he considers as an example of aneurism of the sub-scapular artery. On the other hand, it may be conceived that the sub-scapular artery, the acromial artery, and the circumflex arteries, might, if wounded, give rise to a serious hemorrhage. But of two things, one must take place: either the wound or the tumor is within the reach of the bistoury, and in this case it is necessary to attack the vessel directly upon the diseased part—or the aneurismal affection is too deep to be treated by direct means, and then we can only effect our purpose by having recourse to the axillary artery. Though I have

elsewhere (*Anat. Chir.*, t. I., p. 319, 1825—p. 446, t. II., 1833—p. 380, t. II., 1837) given the method to be adopted to tie the sub-scapular artery at its entrance into the sub-spinous fossa, I do not think it necessary to repeat it in this place.

§ II.—*Intercostal Arteries.*

Cases of wound or aneurism of the intercostal arteries have been related by various authors. Ruysch, A. Petit, Walter, (*Ancien Jour. de Méd.*, t. LXV., p. 313,) Delmas, (*Questions Chirurgicales pour Concours*, Montpellier, 1811, p. 7,) and Briot, give examples of them. M. Floret, (*Thèse* No. 6, Paris, 1836, p. 20—*Arch. Gén. de Méd.*, 2e série, t. XII., p. 337,) in fact, relates the case of an individual who had the four first intercostal arteries covered (*criblées*) with true aneurisms. But the operations to be performed in a case like this will be found under the head of the article on *Empyema*.

§ III.—*The Internal Mammary Artery.*

The internal mammary artery, besides being of sufficient size to give rise to spontaneous aneurisms, is also very much exposed to wounds. Chopart succeeded in arresting a hemorrhage from it in a child, by means of compression. Bonet relates a case where a wound of this artery caused the death of the patient. M. Demon-tègre (*Thèse* No. 14, Paris, 1826, p. 6) gives the history of a man seventy-six years of age, who died five weeks after receiving a wound from a sabre, and in whom an aneurism two inches long was found in the internal mammary artery. It is also certain that wounds of this artery have quite frequently occasioned death, as in the case of Bonet. It would be important, then, to possess a process by which we might be enabled to lay bare this vessel and tie it. Here is the one which I was the first to point out near fifteen years since.

As the mammary artery crosses the cartilages of the ribs behind, at two, three, or four lines on the outer side of the sternum, we may cut down to it by dividing the tissues to the extent of two or three inches, in a direction parallel with the border of the bone, and by preference upon the third intercostal space, which in truth is the largest of all. After the integuments, we should have to divide the sub-cutaneous fascia, the fibres of the pectoralis major, the internal extremity of the intercostal muscle, and some cellular lamellæ. The thickness of the cartilages would show the depth it would be proper to penetrate. The needle of Deschamps, passed from without inwards and brought out from behind forwards, would answer for applying the ligature to the artery without wounding the pleura.

Since I recommended this operation, the ligature upon the internal mammary artery has been proposed or practised by means of processes somewhat different from that of which I have just spoken, by M. Goyrand, of Aix, and by a surgeon of the army of Africa, whose name has escaped me.

§ IV.—*The Arteries of the Penis.*

If Albinus, (Henztault, *Thèse*, Paris, 1811, p. 17,) sustained by Gavard, (*Splanchnologie*, etc., p. 498,) had not related a case of a bloody or aneurismal tumor of the corpora cavernosa, no one would have thought of diseases of arteries of the penis, of which, in fact, I shall not speak, except under the head of the operations indicated for the diseases of this organ.

§ V.

The epigastric artery is also exposed to certain wounds; but I shall have an opportunity of describing the ligature upon this vessel when speaking of the operation for hernia.

[*Anomalous Deviations of Arteries.*—M. Quain (*Anatomy of the Arteries of the Human Body, with its Applications to Pathology and Operative Surgery, with a Series of Lithographic Drawings, with Practical Commentaries*—by Richard Quain, Professor, &c., London, 1844; see also *Edinburgh Med. & Surg. Journal*, Jan. 1, 1845, No. CLXII., p. 199, &c.) has seen the trunk of the brachial artery separated by a considerable interval from the biceps muscle, instead of lying along the inner margin of that muscle, which would cause difficulty in finding the artery, in the application of the ligature. He has noticed what is called the high division of the vessel, occurring in 64 out of 481 cases, or more than one-seventh. M. Quain has never seen a case in which the radial artery was entirely wanting, though he has found it greatly diminished. Professor Otto, of Breslaw, (*Loc. Cit.*, p. 201,) however, cites an instance in which it was entirely absent, while the inter-osseal was larger, and gave to the hand the branch which is naturally sent to the radial.

The deviations in all the arteries are always in an inverse ratio to the size—in the smallest most frequent, and so on.

REMARKS ON ANEURISMS,

BY V. MOTT, M.D.

The pathology of aneurism is now sufficiently well established not to require any particular detail in this place, after the full and erudite account by our learned author, M. Velpeau. We deem it more important to confine our remarks to those of a practical nature. More difficulty attends the diagnosis of aneurisms throughout the chest and lower part of the neck, than practitioners who are merely theoretically acquainted with the subject can possibly be aware of. All the additional light that has been thrown on the subject by auscultation, will be admitted by all practical men, to be as yet an insufficient guide. Many cases are clear and obvious; others, on the contrary, are obscure, and remain unknown until autopsic examinations disclose the truth, when it is too late for the interposition of therapeutic means. All men of experience must acknowledge this fact. The appearance of a tumor in a very remote part from its origin, is calculated to mislead the most sagacious and observing practitioner. And what adds to the obscurity, is often the positive history derived from the patient, and the practitioner who has been in attendance from the earliest period of the case. We have seen instances in the chest as well as in the extremities, in which we have been positively assured that there was no aneurismal character belonging to the case in the early stage, when usually its most striking features are manifested. When now submitted to our inspection, the advanced stage presented fewer of the features by which we are to recognize this disease. Thus for example, we have seen an aneurism of the arch of the aorta, present its tumor above the clavicle in the situation of one which might be thought to have proceeded from the acromial or scapular side of the subclavian artery of the right shoulder. This was its first appearance, and was positively stated to have been unaccompanied with any pulsatory movement of the aneurismal character. The first appearance of tumor, was stated to have entirely passed away; then to have reappeared and advanced forward to the clavicle, and continued to increase and finally encroached upon the trachea and larynx, involving and destroying the clavicle. One of these tumors finally attained the dimensions and shape of a half-loaf of bread. The practitioners and surgeons who saw it before me, differed in opinion as to its nature. A surgeon of eminence, first thought it aneurismal, then he altered his mind and determined to puncture it, and went, as he thought, prepared to do it; but upon searching his pocket, found that he had left his exploring needle at home. Shortly after this, he again thought it to be aneurism. I was now called to see the case and,

without knowing the opinions which had been entertained, deemed it, after a careful examination, not to be aneurism. The surgeon in attendance, now gave me his views of the case, and stated that he now thought it aneurismal. It had a general pulsatory motion, though not the *swell* and general growth in the pulsation which I consider *the chief diagnostic mark of aneurism*. It was soft and apparently fluid throughout, destitute entirely of all thrill or bruit de soufflet, and was stated by a practised stethoscopist, who had repeatedly examined it, to have been devoid of the *bruit* in question, at all his examinations. The incredible quantity of mucopurulent material which the patient constantly expectorated, amounting sometimes to a quart in a short period of time, and which he could always apparently, force into the trachea by pressing his finger on that part of the tumor which encroached on this passage, and which, as he stated in my presence, and as I several times saw him do, gave great relief to the tension of the tumor, necessarily threw great obscurity on the case.

Such was the distressing and imminently dangerous state in which the patient was placed, and the great uncertainty of the aneurismal character of his disease, that I advised with the approbation of the attending surgeon and at the urgent wish of the patient, that the nature of the tumor should be tested by the exploring needle. This was accordingly done, and upon introducing a probe into the aperture made by the needle, it was admitted to the depth of a few inches with the same partial resistance that all practical men know belongs to a malignant tumor. A second puncture was made and the same results were obtained. Only the most trifling quantity of dark grumous blood issued from the punctures, and the same appearances were seen upon the probe. My colleague now thought the disease a malignant tumor, as I myself also did. The apertures were now closed by a strip of adhesive plaster. The patient continued in a most suffering condition for a few days and then expired. Great interest was naturally excited to determine the nature of the case, by a post mortem examination.

This inspection proved that the case was in reality, an aneurism of the arch of the aorta only, just below the origin of the innominate. The aperture at the aorta, was the smallest and seemed to be the most natural and healthily organized opening that I ever saw in any case. To the smallness of the opening and the remote distance of the tumor from this aperture, may be ascribed the difficulty which existed of forming a correct diagnosis.

If this tumor had originally presented the true aneurismal character, it would naturally from its location, have led a surgeon to the question of tying the innominate, upon the cardiac principle of treating aneurisms; as no other artery in this case could have offered as many advantages to the patient.

We believe that tying the *subclavian of the right shoulder within the scaleni muscles* offers in fact in all cases, less chance of success in consequence of the proximity of the origin of the several branches which it ordinarily gives off. In two of the operations

which have been performed upon the subclavian at this point, one by Dr. Colles of Dublin, and the other by myself, the patients in both cases perished from secondary hemorrhage. In the two remaining and recent instances, which were those of Mr. Liston and Mr. Partridge, the same result ensued.

If an aneurism of the aorta can first present itself at so great a distance from its origin, and when it is considered at the same time that it much more frequently happens that it presents itself nearer its origin, how cautious ought we to be in our diagnosis and determination to operate, when we find aneurismal tumors situated at the lower part of the neck and about the clavicles.

All surgeons, whose opinions are of any value, will readily excuse mistakes that are made by even those who have had the greatest experience, because, notwithstanding all the light afforded by pathological investigations and stethoscopic examinations, it will we think, be generally admitted by the profession, that no subject is more difficult and obscure than that of sub-sternal and thoracic aneurism.

Certainly when aneurisms show themselves as they ordinarily do near their origin, destroying the super-imposed tissues, soft and hard, and presenting a pulsating tumor to the eye and touch, the true nature of the case is almost self evident. But when they *sprout out* to a great distance from the trunk on which they have originated, in the form of a long tube or neck, developing their true character at a remote point, the diagnosis must necessarily always be exceedingly difficult.

It is in most of these aneurismal tumors, which appear about the lower part of the neck and shoulders, that the distal operation is most frequently thought of as the only one which is practicable.

From the uncertainty therefore of the origin of aneurismal tumors which appear about the upper part of the sternum and clavicles, we can readily understand why the distal operation must frequently be of no avail. For it is well known that, when an aneurismal tumor shows itself above the upper bone of the sternum, it happens as often that it proceeds from the aorta as from the innominate. Therefore after tying the carotid upon the distal principle, though the artery should heal kindly, there will be no diminution of the disease. So also if we tie the subclavian beyond the scaleni muscles for a supposed aneurism within those muscles, the operation is equally useless; as in both cases the aneurism may proceed from the aorta itself.

If, fortunately, however, as has been our lot, in a case of aneurismal tumor above the sternum, it has been proved to be situated in the innominate itself, we believe and know that the tying of the primitive carotid has caused the entire disappearance of the tumor.

We know also that when the innominate is aneurismal itself, that nature makes an effort to cure the disease by plugging up, or obliterating, one of its two great branches; either the subclavian or the common carotid. We have thus seen several cases in which either one or the other of those two great trunks, spontaneously

ceased to convey blood to their branches. In two instances in which we have operated for an aneurism of the innominata on the distal principle, no pulsation could be discovered in the subclavian, axillary, brachial or cubital arteries of the right thoracic extremity; but the pulsation of the primitive carotid continued with even more force than natural. Ought not such facts as these to lead every reflecting surgeon to adopt and practise the distal operation upon the only pervious trunk adjacent to the aneurism? Thus, in the two cases above mentioned, I tied the primitive carotid because the subclavian appeared, so to speak, to have been spontaneously plugged up.

In all such cases, therefore, the surgeon ought to be governed by this principle, and thus co-operate with the salutary efforts of nature. If the subclavian should be the pervious trunk, that should be tied *without the scaleni muscles and never within*, under this or any other circumstances, as we have already stated.

If the carotid be the pervious trunk, that should be the one to tie. If both be pervious, both should be tied at the same time.

We have verified occasionally the excellent and practical diagnosis of these aneurisms as laid down by Mr. Wardrop of London; but we nevertheless believe it to be insufficient in the majority of cases to enable us to arrive at a correct opinion. We know very well, as before stated, that sub-sternal and thoracic aneurisms will sometimes be first manifested in the several situations pointed out by Mr. Wardrop; but we know also that a tumor which shows itself above the first bone of the sternum, and the tumor that appears between the origins of the sterno-cleido mastoid muscle and upon the outer edge of the clavicular portion of that muscle, instead of denoting an aneurism of the arteria innominata, common carotid or subclavian, as he would infer, may be in either of these several situations in fact an aneurism of the aorta. An operation, therefore, which may be performed upon the distal principle, of tying the carotid or subclavian, must ever in such cases be fruitless and unavailing.

The Arteria Innominata.—In all cases, therefore, in which it may be proposed to tie the innominata upon the cardiac principle, more or less of doubt must remain in the mind of every enlightened and experienced surgeon. For notwithstanding all the aid of auscultation or other means, the aneurism for which the innominata shall be tied may prove to be sub-sternal or thoracic, and nevertheless present a tumor in the situation of an aneurism of the subclavian itself.

Fortunately for ourselves, in the operation which we projected and first executed upon the arteria innominata, the disease proved to be connected with the subclavian only, and the operation was truly on the cardiac principle; and we believe such has been the case in all the subsequent operations upon this great arterial trunk, which, as will be seen by the text of M. Velpeau, amount to five besides my own, and which, as far as my information reaches, are all that we possess any authentic account of.

Although this great and difficult operation has never yet suc-

ceeded in effecting a permanent cure, still the spontaneous separation of the ligature at the usual period, satisfactorily proves that when this artery is in a sound state, as it always should be when we attempt to tie it, it will, though a great trunk and so near the heart, heal by adhesive inflammation. In my case, as will be seen hereafter, the ligature separated on the fourteenth day, and the healing process had nearly completed the closure of the wound before an ill-conditioned ulcerative action had commenced : showing as I think conclusively that but for the vitiated habit of my patient the operation would have resulted in a perfect triumph.

This man was sufficiently recovered to walk in the grounds adjacent to the house for some days previous to the commencement of the ulceration which ended in fatal secondary hemorrhage. No inconvenience was experienced by the patient, either in the functions of the heart, lungs or brain, or in the perfect exercise of all the functions of the right superior extremity ; proving conclusively in our mind that the tying of the innominata on this principle, is not only a practicable but proper operation. The close proximity of the disease in the subclavian within the scaleni muscles in this case, was an untoward circumstance perhaps for a favorable result. This was seen during the operation, and forbade the application of the ligature to that vessel, and left no alternative but the brachiocephalic trunk. I felt emboldened to take this step, which up to that time had as is well known never been ventured upon in the living body by any one, by the solitary fact stated by Allan Burns, that in making an injection in the dead body, after applying a ligature to the innominata, he found some of the injection had passed into the right superior extremity. Knowing this fact, I had been in the habit for several years, in my surgical lectures, of showing the practicability of applying a ligature to this artery, without wounding the pleura, and thereby opening the right cavity of the chest. I had therefore no doubt in my mind as to the possibility of accomplishing this operation upon the vessel if proper care was observed ; but I confess, notwithstanding the fact of Burns, I had many misgivings as to the preservation of the right superior extremity. I said to myself that if injection can by this circuitous channel find its way into the arm, the blood would with much more certainty do the same. And I was delighted with the result, that this member suffered no more inconvenience for the want of nourishment than if the brachial only had been tied.

I am aware that many surgeons will still doubt the propriety of attempting any future operations upon this artery, as all the cases have terminated fatally. Yet I am free to say, that if ever a case should present itself to me again, I should *tie the primitive carotid at the same time that I tied the innominata*, as both can readily be done through the same incision. I am very well aware that this would be objected to by some as inflicting an extent of operation new and untried ; yet it seems to me, that by thus intercepting the retrograde current through the primitive carotid, there would be less chance of any reflux hemorrhage in the event of a phagedenic

ulceration being set up in the wound. This is, however, a most momentous question for a surgeon to decide upon, and must ever be left to his own judgment and discretion.

Until my operation was performed, no surgeon had ever ventured thus to rob the brain of at least half its blood. This alone was certainly a hazardous experiment, but we were gratified in the result, and subsequent experience has extended this principle even still farther than any one would have anticipated. For we now know that the full functions of the brain have been performed for six days, by one vertebral artery alone, (See case of M. Rossi in the list above.) In all the cases in which both the carotids have been tied, an interval of some months has generally been allowed to elapse. In one of my two cases twelve months passed away before it became necessary to tie the remaining carotid. This young man did not experience the least inconvenience when the circulation was interrupted through the last carotid, and he recovered perfectly.

In the other case, which I have never yet published, the imminently hazardous and formidable character of it was such as to justify, in my opinion, the tying of both carotids at the same time, with an interval of only about fifteen minutes. Coma and stupor in the course of a few hours supervened, and he died within forty-eight hours.

If the primitive iliac, when tied, will heal, and we, by this operation, save the patient's life, why may we not with perfect propriety yet hope, that some one is destined, in the brilliant march of surgical triumphs, to obtain the like happy result from a ligature on the innominata? The force of the circulation must be as great and as direct in the primitive iliac, from its proximity to the aorta, as it is in the brachio-cephalic trunk. My hopes are not at all dampened by the hitherto repeated failures of this operation; and I fondly anticipate that the day may come when some one of my countrymen may yet be heralded as the successful operator.

The Subclavian Artery within the Scaleni Muscles.—The relative anatomy of the right and left subclavian arteries, within the scaleni muscles, compels us to believe that the right only can ever be thought of as proper for a ligature. The deep origin of the left as a primitive trunk, from the arch of the aorta, and its associations with the deep jugular, and the thoracic duct, should forbid in our opinion, any attempt ever being made to put a ligature upon it. The right, from its high origin from the brachio-cephalic trunk, makes it more readily accessible in a surgical operation. It was first tied by Dr. Colles, of Dublin; he unfortunately lacerated the pleura, by which the cavity of the chest was opened, and his patient died in a short time, before the ligature had an opportunity of becoming separated.

In my case, which was the second, and performed under the most favorable circumstances, as to health and moderate extent of disease, full time was allowed for the spontaneous separation of the ligature. But, unfortunately, while separating, arterial blood

showed itself, which, as can be readily imagined, was a humiliating and appalling event. This discharge was repeated from time to time, through an opening barely large enough to admit the passage of the ligature, showing, conclusively, that the ulcerative rather than the adhesive process, had been produced by it. This amounted by degrees to an actual hemorrhage, which, in a few days, wasted the energies of my patient, and ended in death.

From the number of large arterial branches which are given off by the right subclavian in its course from its origin to the inner edge of the scalenus anticus muscle, we very much doubt whether a ligature will ever be applied successfully to it. The distance between the origin of these branches is so small, that an opportunity, in our judgment, is not given for the adhesive process ever to be accomplished.

This is, at present, the apprehension we entertain; but we shall be happy to find hereafter that our fears shall have proved groundless. In truth, if we are warranted in expressing an opinion, we think there is less to be hoped for, in the application of a ligature here, owing to the fact of these several branches coming off within so short a distance of each other, than there would be in tying the arteria innominata itself.

Ligature in the Middle or Scalenus portion of the Subclavian.—We do not see any reason to doubt but that a ligature may be successfully placed on the middle or *scalenus* portion of the subclavian, for it appears to us to be sufficiently distant from any considerable branch to allow of complete adhesion of its walls to take place. Dupuytren is said to have tied it in this situation: we have repeatedly done it on the dead subject, and believe it a proper and practicable operation. Great care must be taken by the operator that he does not injure the phrenic nerve, as it runs directly over the anterior surface of the scalenus anticus muscle.

The Subclavian without the Scaleni Muscles.—The subclavian in this part can be tied in a surgical operation with equal facility on both shoulders. Since the time of Mr. Ramsden, who first tied this artery above the clavicle, it has been performed in different countries by various persons. It is due to our country, and to our distinguished citizen, the late Dr. Wright Post, to state that he has the honor of having first performed this operation *successfully*. I had the pleasure of assisting him in it, being united with him in the case. Since that period, it has fallen to my lot to have tied this artery *four times* for aneurism, all of which cases resulted in complete success. Several of the cases have been published in the journals of our country.

This operation must always be viewed as one of great importance; but with the knowledge of anatomical relation, which has added so much lustre and precision to modern surgery, it can be accomplished by a careful operator with great satisfaction to himself, and great benefit to his patient.

The Left Subclavian within the Scaleni Muscles.—The deep origin of this artery as a primary branch from the arch of the aorta, and

its consequent more intimate relations with the deep jugular, pneumo-gastric nerve and transverse vein, and lastly, more important still, the thoracic duct, would we repeat make an attempt to place a ligature upon it too hazardous, in our judgment. We saw the first, and perhaps only attempt that ever was made, to tie this artery. This was by my illustrious and revered preceptor, Sir Astley Cooper. After working indefatigably with all his eminent skill and superlative tact for an hour and a half, he abandoned the operation as hopeless. The patient died in the course of a few days.

The Primitive Carotid.—Since the *first* attempt, and unsuccessful attempt, by Sir Astley Cooper, to cure an aneurism of the carotid on the cardiac principle, a great number of surgeons in different countries have tied this artery for that and other affections.

We were present at Sir Astley Cooper's second attempt to tie this artery, and the issue was fortunate. Dr. Wright Post was also the first who succeeded in this operation in this country. I have tied the primitive carotid for aneurism, and for various other purposes, TWENTY-THREE times, most of which, all in fact, but two, have terminated favorably. Two of these cases were for *navi materni*, i. e., aneurism by anastomosis, one an infant of three, and the other of six months, and in both a radical cure of the disease was effected.

There is the best ground for hope that the ligature on the common carotid upon the cardiac principle, will continue to be a very successful operation, in consequence of its giving off no branch whatever throughout the whole length of its trunk, a most curious, interesting and important fact. Although we have ourselves tied the external carotid as a preparatory step to the exsection of the parotid gland, we nevertheless believe that it is preferable in such cases to tie the primitive trunk. Our reason is, that it is much more accessible, and the operation much more easy, and that it does not, in our judgment, in the least degree, augment the danger. On the contrary, the ligature being more remote from any arterial branches than it would be on the external carotid, makes the operation more safe to the patient.

The Anti-Cardial, Distal, or Brasdoreal Operation.—My opinion is, that it is the duty of the surgeon to make trial of this method rather than leave his patient to perish. Although the instances of success are very few, yet in our view they are sufficient to justify the operation. Deschamps and Sir Astley Cooper first availed themselves of this process, which was only recommended, but never had been performed by Brasdor, whose name it bears. These cases were for femoral aneurism, so high up that the femoral artery could not be tied below Poupart's ligament; and as no one yet had ventured to tie the external iliac, these two surgeons tied the femoral below the disease. Both these patients, however, unfortunately died. The surgical world is more indebted to Mr. Wardrop than to any other person, for having revived this practice and applied it to the great arteries of the neck and shoulders. A number of attempts have now been made upon the carotid and sub-

clavians, upon this principle, and some successes have crowned these efforts. The carotid has been successfully treated in this way. We have tied the carotid *twice* on this principle for aneurism of the *arteria innominata*. In one case, secondary hemorrhage after the ligature had separated, led to a fatal result. In the other case, which was my first, I feel authorized in saying, that it was successful. The ligature separated kindly, and the wound healed. The tumor above the sternum, which had been near the size of the fist, entirely disappeared. My patient returned to the country, and died at the expiration of about a year from the time of the operation; but no tumor had ever reappeared above the sternum. He rigidly persevered in the most abstemious and starving diet, contrary to my express injunctions, and became frightfully emaciated. Cough then supervened, with difficulty of breathing, with which he gradually perished. The post-mortem, which we shall annex with the description of the case, shows that the aneurism of the innominata had shrunk to a solid and extremely indurated mass, having almost a stony hardness, the pressure of which on the bronchi, led to the pulmonic difficulties which have been stated. My firm belief is, that if he had used a reasonably nutritious diet, his strength would have been sustained, the resources of art aided, the tumor perhaps absorbed, and his life saved. We think there cannot be a better established principle than that the energies of the system frequently require aid, in order to enable it to remove surgical diseases. The extravagant, depletory, and starving system of Valsalva, in aneurisms, and of other practitioners for other diseases, deserve to fall, as they are doing rapidly, into disrepute. My patient may emphatically be said to have died while he was being cured.

Arteries of the Superior Extremity.—The *axillary artery*, from its origin at the first rib, until its termination opposite the lower border of the axilla, we have tied in a number of instances; and where it can be done for an aneurism of the brachial artery, it is much more simple and proper than the tying of the subclavian above the clavicle. The parts to be encountered are much more simple, and the operation more readily accomplished if the surgeon be fully posted up in the anatomy of relation. Keeping close to the inner fold of the axilla, and arriving at the coracoid process of the scapula, the artery can be readily followed up to the lower margin of the first rib, at which point this vessel commences. We would reprobate here the practice which has been recommended, and followed by some, of cutting through the thick part of the pectoralis major, by an incision just below the clavicle. The numerous branches of veins which are *always* encountered here before arriving at the trunk of the axillary vein, makes it a much more hazardous and difficult operation than some may imagine who are not familiar with the anatomy of the parts. And when the trunk of the vein is reached, the operator must search for the artery higher up, and either go above, or below, the great venous trunk in order to find it, and apply his ligature.

This operation, like many others in surgery, is too loosely and carelessly described; showing clearly, to a practical operator and one versed in relative structure, that all who describe operations are not more familiar with the parts they describe than many are whom we see cut into them. It is one thing to describe, and quite a different thing to perform, an operation.

The *brachial* or *humeral*, from its superficial course, first along the inner edge of the coraco-brachialis, and then the inner edge of the biceps, makes a ligature upon it an easy operation to a very ordinary surgeon. He must only be careful not to tie the median nerve, which is associated with it differently, in different parts of its course.

We may, with great propriety, emphasize upon this nerve, for we have known a distinguished surgeon pass the aneurismal needle through its centre, besides including the brachial vein along with it; which procedure, as might be expected, ended in the death of the patient.

We have had some experience also in wounds of the *brachial artery in venesection*. We are happy to say that in our long career of practice, we have never had the misfortune to wound this artery with the lancet, but we have several times had occasion to serve our neighbors in this calamity. The first and paramount thing to be recollected whenever this accident should befall any person, is to compress the brachial artery somewhere in its course above the wound, and *never to attempt* compression at the point wounded. For no compression that can be made by an ordinary person will prevent the extravasation of blood.

I have seen in less than an hour after the accident, where this attempt had been made, and as it had been thought, effectually, the whole superior extremity from the shoulder to the ends of the fingers injected with arterial blood, forming thus an enormous diffused false aneurism, so that the limb looked like everything but natural, and was, in fact, frightful to behold.

In this case, however, we made a careful dissection at the bend of the arm, going through from one to two inches of coagulated blood diffused through all the tissues, then carefully tied the artery above and below the wound, and the patient recovered. Under ordinary circumstances the artery can easily be found at the bend of the arm, running between the median nerve and the tendon of the biceps, and may be tied by the least experienced operator. Two ligatures in these cases should always be put upon the artery, one above and the other below the wound.

In all recent cases, therefore we would advise the process above described.

If a *false aneurism* shall have formed simply between the artery and the vein, our practice always would be, to tie the brachial somewhere in its course above, and leave the aneurismal tumor untouched. If the vein be involved with the circumscribed aneurism, the more secure practice certainly is, to tie the brachial artery above and below the aneurism, and exsect the sac; but in every

case I would prefer the more simple practice of tying the brachial somewhere above, and leaving the diseased parts untouched; hoping that the resources of nature would lead to a successful result. If they did not, the former or more severe operation must be resorted to.

If the artery should be wounded, and transmit its blood directly into the vein, the former vessel healing securely and firmly to the under surface of the vein, and only pouring a small quantity of blood directly into it, and thereby distending it an inch or two above and below the cicatrix in the vein, our observation and experience lead us to say, that *nothing is to be done.*

We have not observed even any weakness in such arms; and persons accustomed to laborious employments may be assured that generally no such consequence results from it.

We have seen one *true* aneurism on the *ulnar artery* in its lower third. Wherever an aneurism shall be seated in either of the arteries of the fore-arm, the *radial* or *ulnar* ought always to be tied below the elbow if there is room enough. If not, the brachial must be resorted to.

We have known of several instances of aneurisms in the *palm of the hand* from punctured wounds. The first and very natural step for a surgeon to take, is to compress the arteries at the wrist, one after the other, to determine from which palmar arch the aneurism proceeds. Most generally it will be from the superficial palmar; and therefore on compressing the trunk of the ulnar, the pulsation in the aneurismal tumor will cease. We would recommend, however, that both radial and ulnar arteries be tied in every such case, in order to render the cure certain.

It will not be amiss in this place to state that in all wounds in the palm of the hand in which the branches divided cannot readily be discovered and tied, it is better in all cases to tie both arteries at the wrist rather than be satisfied with the one only whose compression at the wrist shall appear to stop the hemorrhage. We have, in a number of instances from our own experience, seen the hemorrhage return after a number of days; indeed even when the wound was granulating, say nine or ten days after the accident, making it then necessary to resort at last to the second artery of the wrist where only one at first had been tied.

In one instance in a gentleman, now living in this city, who received a small punctured wound from a pen-knife, between the thumb and fore-finger, the surgeon first tried compression, not being able to discover the branch wounded. The bleeding however continuing, he tied the radial artery, which commanded the hemorrhage. Some days afterwards, the bleeding returned and he very properly resorted to a ligature upon the ulnar. Some days more elapsed and the hemorrhage again reappeared. Such was then his alarm that he sought my assistance. The patient, from the extent of hemorrhage, being already exceedingly exhausted, there was no alternative left in my mind but to secure the brachial, which the patient requested that I should do myself. From the time it was

tied, no hemorrhage ever returned. A number of years have now elapsed since this occurred, and but a few days since the patient called to consult me about another matter, and told me he had never experienced any inconvenience in the arm.

My reason for urging that both arteries should be tied at once, even though one should command the hemorrhage, is this, that by tying both simultaneously, you give time for the wounded artery to heal before a free inosculation can be established in the hand, and thereby revive the hemorrhage.

By tying one after the other with an interval of some days between, you do not diminish sufficiently the inosculating circulation, to prevent the recurrence of hemorrhage.

It may not be amiss for me to connect with this important surgical subject, the fact that I have succeeded with *compressed sponge* in these wounds, where I formerly was in the habit of tying the arteries. The sponge ought always to be cut into small pieces, as it is in this way more readily introduced into the bottom of the wound, and by successive pieces makes more complete pressure in all parts of it, and possesses in an eminent degree the great advantage, afterwards, of being gradually removed, as the suppurating process comes on, without doing violence to, or lacerating the newly united vessels. For when a single large piece only is introduced, a very considerable force is afterwards necessary to detach it, which thereby endangers a return of the hemorrhage. (See our remarks on this subject more fully, under the *Dorsalis Pedis*, above.)

The Abdominal Aorta.—We presume that surgeons of the present day, and of all time to come, will confine their attention to the propriety, not the practicability, of tying the abdominal aorta.

This bold and original idea was first conceived by that great master of practical surgery, Sir Astley Cooper. It required a giant, with reputation such as he justly possessed, to give the least sanction to this great step in operative surgery. It is probable that, had this step been taken by any other surgeon, it would have been condemned as rash and unprofessional. It was in an extremity such as surgeons occasionally witness, that this original and bold operation of tying the abdominal aorta was conceived and executed. Projected and accomplished by so great a practical surgeon, it deserves the serious attention of all operators.

It is easy to censure what we have never done ourselves, and nothing is more common, under such circumstances, than to find persons who reproach our best efforts and most justifiable procedures. Those who criticise and condemn the most, are those who, reasoning from the natural structure of parts, are totally unacquainted with the changes that are produced by disease, and the extraordinary exigencies that such conditions call for. Thus, for example, it was easy to say that the danger of his operation was greatly enhanced by cutting through the peritoneum and mesentery; and some thought it remarkable that he did not search for the artery by getting under the peritoneum from the left side. We presume, however, that he was the best judge, from the peculiar nature of

the case. In the natural state of parts, it is certainly more easy, and would appear to be more surgical, to get under the bag of the peritoneum from the left side, by making the incision on the left side, as we shall presently explain. But the circumstances of his case may have precluded the possibility of performing the operation in that way. He was emboldened, in this great undertaking, by a number of facts, which are recorded, of obstructions having taken place in various ways in the abdominal aorta, as related by different pathologists. His own experiments, too, I think, on the aorta of dogs, seem to have strengthened the pathological facts that had been recorded.

The aneurism in his case had nearly arrived at the point of bursting, and we think he was fully justified in resorting to the great experiment which he did, of tying the abdominal aorta, to prolong or save the patient's life.

The case was a most unpromising one in its character, and terminated fatally some hours after the artery was tied. The mere fact of the patient's death, is no argument whatever against the propriety of the operation; for every surgeon knows that several of the first operations upon other large arteries have been attended with the same unfortunate result. It may therefore, for all we know—and we hope it most earnestly—be reserved for some one yet to have the honor of achieving so great a triumph as this will be for operative surgery.

We are far from joining in the clamor of denunciation against all these noble attempts to extend the dominion of our art. We frankly confess that our fears are, that this great and primitive channel of the arterial system will never be tied successfully. To be enabled to interrupt suddenly, by a ligature, so vast a current of blood, and thus to subject the heart to all the *impatience* necessarily thereby produced, seems to us more than can reasonably be expected. The pathological facts, on record, would seem to us to inculcate the propriety of *gradually* closing the artery by some contrivance, by which the heart shall be saved from any inordinate action and distress. All the cases in morbid anatomy, which have been recorded, of complete obliteration of the aorta, must have taken place gradually; and we think we have derived from those facts a basis for this, as it seems to us, important suggestion.

If it were to fall to our lot to meet with a case in which we deemed it proper to obstruct this great channel, we would therefore, if possible, do it *gradatim*; that is, by closing the tube one third say to-day, another third to-morrow, and the last third on the following day. This would be imitating, to a certain extent, the process of nature herself, who ought always to be strictly and carefully watched. It will perhaps be recollected, by some, that this idea occurred to me in fact so long ago as when I tied the arteria innominata. In that case I drew the ligature but partially at first; that is, so as to close the artery only in one half of its calibre at first, which gave me time to observe the effect this had on the

brain, heart, and respiration. Finding these not in the least affected, I was emboldened to close the trunk entirely.

We fully believe that the best mode of getting at the aorta, if the nature of the case permitted, would be on the left side, by an incision extending from the last ribs to the posterior spine of the ilium. By carefully dividing the parts and exposing the peritoneum, the latter can very readily be detached from over the left kidney, after which, by continuing cautiously to raise the peritoneum, the aorta can be arrived at, as it runs on the left side of the spine. This method must be attended with less hazard to the life of the patient, as the peritoneal bag will remain unopened. Besides the greater facility of getting at the artery in this way, it should always be recollected that the ligature upon the aorta ought to be placed as distant as possible from the inferior or superior mesenteric arteries.

The aorta has been now tied four times :—

1. By Sir Astley Cooper ;
2. By Mr. James, of Exeter, (England,) July 25. 1829 ;
3. By M. White, (Encyclograph. des Sciences Méd., Oct., 1837;) ;
4. By Dr. Candido Borges Monteiro, at Rio Janeiro, (Brazils,) July 5, 1842 : The patient lived to the *fifteenth day* ! (See London Lancet, Nov., 1842.)

The Primitive Iliac.—Until my operation upon the primitive *iliac* March the 15th, in the year 1827, (vid. below,) *no one had ever attempted to tie this great trunk for aneurism.* The enormous size of the tumor in my case, reaching from Poupart's ligament to nearly on a line with the umbilicus, induced me to commence the operation in the safe way of getting under the peritoneum from the internal abdominal ring. And although I had to encounter the adhesion of the peritoneum to the tumor, and the delicate and difficult separation of it from that attachment, I nevertheless, deemed it most prudent to adopt this course, not knowing but that I might be able to tie the external iliac. But finding that the tumor reached up to the division of the primitive trunk into the external and internal iliacs, there was left for me no other resource than to apply the ligature to the primitive iliac itself above its middle.

In any future case, I would adopt the same, and what I deem a prudent course, rather than cut down directly in a line with the track of the artery upon the peritoneum itself. For I consider that one very great danger in all these operations about the peritoneum where great arteries are to be tied, consists in wounding this membrane. I had been in the habit for many years before I met with this case, of showing in my lectures the practicability of the operation by pursuing the course which I have just pointed out. All this is very easy upon the dead subject where no disease exists. But on living man with a formidable tumor before you the case is far otherwise.

My patient recovered without an untoward circumstance, and was still alive and in the enjoyment of excellent health, in April

1841, when he paid me a visit soon after my return from Europe, furnishing thus another triumph of our art.

Some years after the above operation, Sir Phillip Crampton of Dublin, also performed it. His patient died of secondary hemorrhage.

Mr. Salomon's case (St. Petersburg, Russia,) was I believe the next, and his patient recovered.

Mr. Guthrie of London, also performed this operation for a supposed aneurism. Sir Astley Cooper and other distinguished surgeons were in the consultation. After death the disease was found to be a malignant tumor, and not aneurism.

Mr. Syme of Edinburgh, also tied the primitive iliac, and his patient died.

Dr. Peace of Philadelphia, has also recently, within two or three years performed this operation with success.

Some months after the apparent recovery of this case, the tumor returned, and the patient died.

To those who have criticised my mode of tying this artery, by saying that the incision terminated where it should have begun, I would reply that such persons would do well to reflect that those who see a case are generally the best able to judge what ought to be done. Such commentators, should they be so fortunate as to live long enough, would find themselves becoming more and more modest as they had more and more experience.

The Internal Iliac or Hypo-gastric.—This important vessel was first secured in a ligature by Dr. William Stevens, of the Island of St. Croix, West Indies; for an aneurism in the gluteal region, in a negress. The patient recovered, and lived many years, and died of another affection. The parts were removed, and I saw the preparation on board ship at this port (New York,) in possession of the operator on his way to London. My belief, from an examination of the specimen was, that the internal iliac had truly been tied. Some doubts have since been expressed on this point at London; but these were entirely removed by a committee of the Royal College of Surgeons, who carefully inspected the preparation, and found the internal iliac completely obliterated above the point where the ligature had been applied.

It may not be amiss to remark in this place, that we have also known instances in which anatomists and surgeons have pronounced the sentence that an artery had not been tied, because on making a superficial examination of the specimen, there appeared to be at first sight a continuous trunk of artery. From our observation in these cases, although the ligature has as we know actually made its way through the artery by the process of ulceration, and necessarily therefore divided it, the granulatory process follows so rapidly upon the ulcerative, that the solidification in this place has the appearance externally of an uninterrupted trunk. This we have noticed several times in our dissections; and the deception has occasionally led to illiberal and ill-natured remarks, which however have always ultimately recoiled upon those who have made them,

and justly stamped the authors as both ignorant and presumptuous.

Mr. Atkinson, of York in England, afterwards performed this operation, and his patient died.

The third operation was by Dr. S. P. White, of Hudson, in the state of New York. His patient recovered.

The next and last, as far as we know, was performed by myself, at New York, on the 29th of December, 1834. The result was completely successful. The patient still lives, in perfect health, and frequently calls to see me.

When aneurism exists in the *gluteal region*, we believe it utterly impossible for any surgeon to say whether the disease is seated in the gluteal or ischiatic artery.

These arteries emerge from the pelvis so near together, that, *a priori*, the identification of an aneurism in one or the other is totally impossible. Those persons who have suggested the practicability of tying the trunk of either of those arteries on the cardiac principle, can *never have seen an aneurism in this situation*. Like many other great operators upon paper, they have formed their ideas in favor of, or against, an operation, merely by the dissection of the dead body. These are generally the most vindictive and censorious critics, and the most ignorant and dangerous surgeons. It must always be recollected that they predicate their conclusions as to the practicability of surgical operations on the living body by the beautiful delineations of normal structure. Those who choose to retrograde to the ancient practice of opening the aneurismal sac by an incision *a foot or two long*, and reach for the artery *at arm's length*, in the midst of a *gallon or two of coagulated blood and the gushing and roaring of the vital torrent*, are at liberty to do so if they please.

For our part, we prefer the more genteel method of tying the primitive trunk itself within the pelvis. It is only in all recent wounds of the region of the trunk of the gluteal or ischiatic arteries, that we should use all commendable industry and care in endeavoring to secure and tie the bleeding vessel, or to command the hemorrhage by the mode we have already pointed out, with small pieces of sponge and pressure.

The External Iliac.—The honor of first tying this artery belongs to John Abernethy. He was, in fact, the first person ever known who ventured to put a ligature in living man above Poupart's ligament and under the peritoneum. The case terminated successfully. Mr. Freer and Mr. Tomlinson, of Birmingham, in England, followed next; and after them, Sir Astley Cooper, in a case which I had the satisfaction of witnessing while I was his pupil. The operation has since been repeated by a great number of surgeons, in various parts of Europe, in America, and also in India.

In our country, the external iliac was first tied by Dr. Dorsey, of Philadelphia. (See his Surgery.) It was next performed in our city, by Dr. Wright Post, in the New York Hospital. Afterwards by Dr. Smith of New Haven, Dr. Jamieson of Baltimore, Dr. Whitbridge, Dr. A. H. Stevens, Dr. David L. Rogers, and others.

I have tied this artery *six times*; four of the patients recovered perfectly. One died from peritoneal inflammation, in consequence of imprudence in spirituous drink; the other, from secondary hemorrhage.

In tying the external iliac artery, we have always pursued the plan last recommended by Sir Astley Cooper; and we have no hesitation in saying that, in our opinion, it ought always to be followed as the safest and best method. It is obvious that the great danger in the operation is the wounding of the peritoneum; and whoever cuts directly upon this membrane, must always incur considerable hazard, either from his own unsteadiness or the motion of his patient. By the method recommended by Cooper, we commence the incision just above the external abdominal ring, and carry it a little above Poupart's ligament, to within a small distance of the anterior superior spinous process of the ilium. After cutting through the integuments, the superficial fascia, and tendon of the external oblique muscle, we expose the muscular fibres of the internal oblique. Upon detaching a few of these from the upper and inner edge of Poupart's ligament, we lay bare the spermatic cord. Pinching up the cylindrical process of the cord, and dividing it with the knife transversely, the finger is readily passed up the inguinal or abdominal canal, and arrives at the internal abdominal ring. We now know that the finger, by being passed into the internal abdominal ring, is certainly below the peritoneum, and that this membrane, with gentleness and care, can readily be pushed upwards, and may be detached to any distance above and below, so as to expose the artery as high up as may be necessary for the ligature. It ought always to be recollected, by an operator, that immediately behind and below this internal ring, the external iliac is to be felt. This mode of operating has always appeared to me to be by far the most safe on this account: that you are sure of getting below the peritoneum—and it has, in our judgment, a decided preference over the methods of Abernethy, and others who followed him, by cutting down upon the peritoneum, by means of a longitudinal incision, more or less in a line with the *linea alba*.

In *all our operations on the Iliac arteries*, we have invariably adopted the kind of incision we have above described for the external iliac. Our object previously has been to be sure of getting below the peritoneum. This being accomplished, by going through the internal ring, we then, by continuing to push up this membrane, may divide the super-imposed parts in any direction and to any extent we think proper, to enable us to reach either the primitive or the internal iliac; *always taking care to keep the peritoneum well pushed up before dividing the parietes*. Recollecting always, however, that when the finger is in at the internal ring, the epigastric artery must always be on the inner side of the finger, and that cutting in that direction is therefore to be carefully avoided.

In one of the cases in which we tied the external iliac, there

were some peculiar features which make it deserving of particular mention.

A man aged about 35 years, of a vitiated habit, presented himself to me with a true popliteal aneurism on the right leg, and an inguinal aneurism on the left. Both were circumscribed, and each about the size of the fist when he called upon me. I urged him to submit to surgical operations for their cure. He however preferred to postpone any surgical interference until it should be more urgently called for. About a year from the time of my first seeing him, he sent for me to relieve him, saying that he feared he had deferred the matter too long. I found his popliteal aneurism now increased nearly to the size of a *man's head*, blue, cracked, and oozing a sanious fluid from the surface, and in the most imminent danger possible of bursting every moment. I immediately tied the artery in the lower part of the upper *third* of the thigh. In a few days an extensive surface of the aneurism gave way, and discharged a hatfull of coagula. Nevertheless, when all these latter had escaped, suppuration and granulation kindly took place, and the whole of this immense ulcer healed up, leaving him only with a little contraction about the knee joint, and shortening of the limb, not so much, however, but that he could still bring about half the plantar surface of his foot to the ground.

About a week after I had applied the ligature to the femoral artery, he sent for me in great haste. Having visited him on the same morning, and found him doing well, I was somewhat surprised at receiving an urgent message that he was suffering intolerable torture, and labouring under the greatest anxiety and alarm. This condition, on arriving at the house, I found arose from a sudden sensation of something giving way in the inguinal aneurism on the other side, which was, in the morning, a little larger than an ordinary sized fist, but now I found had attained more than double this volume. The tumor extended upwards and downwards—reaching upwards considerably above Poupart's ligament. In truth, this circumscribed true aneurism had suddenly become diffused.

No time was now to be lost. I immediately, therefore, tied the external iliac; every thing went on well, and the patient perfectly recovered of both aneurisms, and is now, near twenty years since the operation was performed, enjoying much more robust health than formerly, and with very little impediment in walking; requiring only the heel of his boot on the limb which had been affected with the popliteal aneurism, to be made a little higher than the other. This curious case has never before been published.

The Femoral Artery.—This artery may be tied in any part of its course. We always prefer, when we have a choice, the lower part of the upper third, as recommended by Scarpa, and now called by Professor Velpeau and others, Scarpa's space. The artery here is most superficial, lies directly below the inner edge of the sartorius muscle, and requires that this muscle should be but very

little disturbed in order to get at the vessel. We have, in our practice, tied the femoral artery *forty-nine times*.*

Some surgeons have doubted the propriety of tying the artery between the going off of the profunda and the origin of the epigastric. We have, however, several times put a ligature here, and in every instance with success.

In one instance we have tied the *popliteal* successfully. We have, in a number of instances, tied the *anterior and posterior tibial arteries*, in different parts of their course. In one case, an aneurism of the anterior tibial on the dorsum of the foot, where it is called the *dorsalis pedis*, we found it necessary to tie, not only the anterior tibial, but also the posterior.

In tying the anterior first, it seemed for a while to promise a cure of the aneurism; but the tumor, after some time, began to increase in size. We then tied the posterior tibial artery, and the case resulted in a perfect cure.

In wounds of the *dorsalis pedis*, as we have mentioned in a note above, it ought to be recollected that we are always to tie both ends of the wounded artery.

In wounds of the *plantar arteries* in the bottom of the foot, or in a wound between the great toe and the one adjoining, when the wounded branches cannot be readily found, the best practice is to tie both the anterior and posterior tibial arteries at once, on the same principle, and for the same reasons that we have recommended the arteries of the wrist to be tied in wounds of the palm of the hand.

On the Method of tying Arteries, and on Ligatures, Dressing, &c.
—We would advise all who tie large arteries, to bear in mind, that after the edge of a muscle is laid bare, which is the anatomical guide or landmark for the relative situation of the artery, that very little use should be made of the knife.

With his fingers, or the handle of the scalpel, the surgeon can readily separate the parts, so as fully to expose the artery. In this way he will be much less troubled with the oozing of blood, from cutting the small vessels, and thereby better enabled to see the principal trunk more distinctly.

With the parts held asunder with curved spatulas, the surgeon now seizes the filamentous structure with the forceps, and raises it from the artery. He then cautiously divides the structure *perpendicularly, and upon the anterior surface of the artery only, and should never dissect or use the edge of the knife on the sides of the artery, but introduce the handle of the knife, and separate the structure from the artery on each side, only denuding the vessel to an extent barely sufficient to allow the hook to be passed around it.*

This rule we believe most important, as by using the edge of the knife on the sides of the artery we endanger frequently the division of branches, as most of these are given off laterally; and

* Since this chapter was prepared, I have tied the femoral again above the profunda.
—V. M.

the flow of blood where they are divided, obscures and interferes very much with the beauty and the neatness of the operation.

Denuding the artery, also, to any considerable extent of its filamentous structure must, by robbing the vessel of its connecting media, always be adverse to the salutary changes which we expect from the ligature.

For passing the ligature, we have always used the *American aneurismal hook*, which we consider the best that has ever been invented.*

To use this most prudently, we always *introduce it from the vein*.

We prefer the *small, strong round ligatures of silk or flax*, and we only use *one* around the vessel. We have come to the conclusion long since that one ligature is quite sufficient. Formerly, in many instances, we used two ligatures, about an inch distant from each other. Then, in other cases, we divided the vessel in the interspace; again, we adopted the expedient of passing the ligature through the artery, above and below where it was tied, tying it again, and then dividing it in the interspace. In another case we used two remarkably delicate ligatures of *raw or flossed silk*, each ligature not weighing over the sixteenth or twentieth of a grain, and we divided here also the artery in the interspace, and then cut both ends of each ligature close to the vessel. We then healed the wound by the first intention, the first dressing being the only one required. This all seemed very beautiful; but the sequel remains to be told. Some six weeks after the patient had got about, inflammation and suppuration took place opposite the points of the two little ligatures, and they were discharged.

We have also used animal ligatures of different kinds, as cat-gut, the raw hide, &c.; but we have long since come to the conclusion that the plain simple ligature is the best, and *one* only.

In all my experience for the last forty years in tying arteries, I have *only lost one patient* from mortification of the inferior extremity. This was a case in which the femoral artery was tied higher up than usual; there being a femoral as well as popliteal aneurism in the same limb.

The popliteal aneurism, for some days before the operation, had become diffused from above the knee to the toes, distending the parts to a very painful degree. This inordinate distension of the lower part of the limb, no doubt effectually prevented the inosculating channels from conveying a sufficient amount of blood to preserve its vitality. Should I ever meet with another case of this kind, I would amputate the thigh above the femoral aneurism at once.

In the case of an old man, partial mortification, to a slight extent in the smaller toes, took place; but it was arrested, and he recovered.

My mode of dressing the wound after tying the femoral artery, is

* This aneurismal hook or needle was invented by Drs. Parish, Hartshorne and Hewson, of Philadelphia, many years ago.

to pass a single stitch through the integuments in the centre of the wound. Short straps of adhesive plaster then answer to bring the remainder of the lips into contact.

I then wrap the whole limb in wadding or wool; place the patient in bed, with the limb a little flexed and turned a little outward, with a pillow under the ham.

No bandage of any sort is to be applied on any account whatever. We even avoid *long pieces* of adhesive plaster, for fear that by their compression the inosculating circulation might be interrupted.

Nothing is more dangerous than the application of a tight bandage to an aneurismal limb after the artery is tied; as everything that interferes with the collateral circulation must be to the greatest degree hazardous.

In order that those wishing to refer to our labors, in regard to the subject of *aneurisms and ligatures upon the great arterial trunks*, may have embodied before them an authentic and correct abstract of what we have done in these matters, and of what we consider as our own surgical property, we have prepared and revised the various publications that have been made of our operations in this department, as they are found scattered in different medical periodicals of our country, over the space of the last twenty-seven years. We have arranged them consecutively in chronological order.

The account of the attempt to place a ligature upon the left subclavian, by Sir Astley Cooper, referred to by me above, and in which I had the honor to assist that eminent surgeon, is as follows:—

Case of Subclavian Aneurism, which occurred in Guy's Hospital, London; communicated to Dr. Miller, by Valentine Mott, M.D., Corresponding Member of the Medical Society of London, &c. (See New York Medical Repository, edited by Drs. Samuel L. Mitchell and Edward Miller, 3d Hexade, Vol. I., New York, 1810, p. 331-334.)

On the 20th of August 1809, a man, aged 40, came into Guy's Hospital, in London, with a tumor, occupying the whole of the left shoulder, the greatest part of the clavicle, and extending under the pectoralis major muscle. It was not red upon the surface, but very hard, and without any distinct pulsatory motion: it was of about six months' duration, and, when very small, A. Cooper said he saw it, and there was no distinct pulsatory motion to be discovered; at least, only such a motion as the subclavian artery beneath might communicate to a tumor situated immediately over it. The tumor, however, A. C. fully believed to be an aneurism of the subclavian artery; and when, upon examination, an aneurism was discovered in the femoral artery, just below Poupart's ligament, the smallest doubt did not remain, in the mind of any person present, as to the nature of the tumor in the shoulder, and that it was an aneurism of the subclavian artery.

The situation of the man being truly painful, and it being evident that the disease must prove, in a short time, fatal, if no operation were to be performed, A. C. was determined to make an attempt to take up the subclavian artery, just after it had passed betwixt the first and second scalenus muscle.

Though this would appear to many to be a cruel and unwarrantable attempt to save life, yet, as A. C. very properly observed to me, it could only shorten his days a little to attempt the operation, and it was possible it might succeed, though it had never before been performed.

The man was willing to submit to anything that might be thought proper for the relief of his distresses. A. C. then pointed out to him the uncertainty of the operation, and promised, if he would submit to it, that nothing should be done but what was perfectly proper and safe; saying, that if, in the course of the operation, he should find it not safe to proceed, he would give it up. The man consented, and was laid upon the table in the theatre, with his shoulders a little elevated. The operation was then begun, in the presence of G. W. Young, Esq., Surgeon, B. Travers, Demonstrator of Anatomy, and a number of other surgeons. The incision was commenced at the outer and lower edge of the sterno-cleido-mastoideus muscle, close to the clavicle, and carried, straight outwards and backwards, about three inches. The most careful dissection was now necessary, and by means of the edge, and sometimes the handle of the scalpel, the muscles were separated, till the nerves, going to form the axillary plexus, were laid bare. The opening between the muscles was very small and so deep, (*A. C. remarked that it was like looking down a well*), that the fore finger could but just reach the nerves. The subclavian artery was felt beating very feebly, immediately under one of the large nerves going to the axilla; it could not be felt at all by several that were present, and by none constantly; A. C. was convinced that he felt it at times, and I was certain that I perceived it also. A curved probe was now passed under the artery, and repeated trials were made to draw it from under the nerve, so as to pass a ligature around it; but these were all unsuccessful. Every time the nerve was put upon the stretch, with this view, the patient complained of the most excruciating torture, not only in the shoulder and neck, but extending throughout the whole arm. It was not one or two trials, but many, that were made, before A. C. could be satisfied to relinquish the operation. After, however, keeping the man on the table an hour and fifty minutes, he desisted from any further attempts; saying it was impossible to accomplish it, and even if it were then possible, after so much violence had been done, and the patient so much exhausted, it would not be safe, as it was most probable that it would almost immediately prove fatal. A. C. remarked to me, that the operation, though not difficult in a small aneurism, cannot be performed in one of a very large size. The man did not lose an ounce of blood in the attempt.

The wound was now brought together by sutures and plasters;

the patient put to bed and a large opiate given him. He complained of extreme pain all over his shoulder and arm, occasioned, no doubt, by the violence done to the large nerves, going to form the axillary plexus. A considerable degree of fever ensued the day after the operation, which very much increased; attended with high delirium, though venesection, purging, and sudorifics were assiduously used; and on the sixth day from the operation he died.

Upon examining the body after death, the two first ribs were found to be destroyed, and a portion of the upper lobe of the left lung was adhering to the aneurismal sac; the sac was large, and contained large coagula of blood, which had thrust the clavicle very much upwards. A. C. took out the part, very carefully preserving all the vessels connected with it.

Would any but a great mind, conscious of its own powers, and the rectitude of its intentions, make the following remarks?—He said to me, “I am suspicious that, in this operation, the thoracic duct must have been divided, as it was on the left side; though I did not think of it at the time of the operation, nor before it.” I could not learn that any person present had thought any thing about the danger of injuring this vessel; no doubt from its being a vessel which we have never been accustomed to think of in any operation. I regret that it is not in my power, at present, to satisfy the curious on this point, as A. C. had not ascertained the fact when I left London.

We are not to despair, though this first attempt* has been unsuccessful, when we consider the great and splendid chirurgical achievements of the last three years in the British metropolis. The first operation for carotid aneurism was performed by that eminent and accomplished surgeon, A. Cooper, and was unsuccessful; this, however, did not deter him from a second attempt, in the summer of 1808, which completely succeeded.

After this, the carotid was taken up by an eminent surgeon of Stockholm, M. Bierken; but, from some unfavorable circumstances of the case, it failed, as I am informed in a letter from my learned friend Dr. Wegell, Physician to the late King of Sweden, who assisted at the operation, and accompanied me, when in London, to A. C.’s second operation.

In the winter of 1809, HENRY CLINE, sen., of St. Thomas’ Hospital, took up the carotid for an aneurism of a very large size, involving the posterior angle of the lower jaw, and extending down towards the shoulder. The artery was secured in the usual way, by that great surgeon, and without any kind of difficulty. The man, in the course of the following night, drank very freely of spirits, and became in some measure inebriated, and he died the next day. The parts were examined after death, and there was nothing unusual about the aneurism, but the brain and its membranes showed signs of inflammation. This state of the brain, no doubt,

* KEATE, the Surgeon-General of the British army, and one of the Surgeons of St. George’s Hospital, is said to have taken up this artery, below the clavicle, in a wounded soldier, who recovered.

was induced by the excessive stimulation, and caused his death; as the brain then from its altered circulation, was more predisposed to inflammation.

The carotid was again tied in the spring of 1809, by B. TRAVERS, Demonstrator of Anatomy at Guy's Hospital, for an aneurism by anastomosis, situated in the left orbit, which had protruded the eye a little from its socket. He used two small round ligatures, but did not divide the artery between, and secure the ligatures by passing them through the artery, as was done in the other cases, except A. C.'s first. The ligatures came away in about twenty days, and no hemorrhage ensued, nor did the brain suffer the least injury. The pulsation in the tumor was diminished by the operation; there was, however, but little alteration in its size three months after. Though this operation did not succeed in removing the disease for which it was performed, it is a valuable fact, and proves, with A. C.'s case, that the artery may be tied with perfect safety as to the functions of the brain.*

Abernethy's operations upon the external iliac, and A. Cooper's upon the carotid and subclavian, must be admitted by every one to be master-strokes of scientific surgery. These, most undoubtedly, are proud days for London, and particularly when we know that they have never been the subjects, even of dream or speculation, in the capital of France.

Are we not to expect, from these and similar examples, that the lives of many valuable individuals may be protracted far beyond the period in which their diseases have hitherto proved fatal? They may, indeed, be protracted to a very late age, if we are allowed to judge from similar cases, in which the whole system has not become affected from the disease of a part.

NO. I.—MAY 11, 1818. LIGATURE ON THE ARTERIA INNOMINATA.

The first publication of this operation, was made in a periodical published in New York, and entitled "The Medical and Surgical Register, consisting chiefly of cases in the New York Hospital, by John Watts, M.D., Valentine Mott, M.D., and Alexander H. Stevens, M.D., New York, printed and published by Collins & Co., No. 189 Pearl-street, 1818." Part I., vol. I., p. 9 to 56 inclusive. Also two plates, illustrative of the same with explanations, on the 4th page from the title of the work. The case is as follows:—

Reflections on securing in a Ligature the Arteria Innominata. To which is added a case in which this artery was tied by a Surgical operation. By Valentine Mott, M.D., Professor of Surgery in the University of New York, &c.

Since the publication of Allan Burns's invaluable work on the surgical anatomy of the head and neck, I have been in the habit

* The case of Mr. Travers was ultimately successful. See Medico-Chirurg. Trans., London.

of showing in my surgical lectures, the practicability of securing in a ligature the arteria innominata; and I have had no hesitation in remarking that it was my opinion, that this artery might be taken up for some condition of aneurisms; and that a surgeon, with a steady hand and a correct knowledge of the parts, would be justified in doing it. I felt myself warranted in this, from the singular success which this celebrated anatomist informs us attended his injections, and from my own investigations of this subject. If the right arm, and the right side of the neck, can be filled with injection, after interrupting its passage through the innominata, as we believe they can, who can doubt the possibility of the blood to find its way there also, as it will pass through thousands of channels, which art could not penetrate even by the finest injections? The well known anastomoses of arteries, and the great resources of the system in cases of aneurism, encouraged me to believe, that this operation might be performed with reasonable prospects of success. With all this sanction, and the analogy of the other great operations for aneurism, I could not for a moment hesitate in recommending and performing the operation.

The following operation, as the steps of it will show, was performed with the two-fold intention: 1st, of tying the subclavian artery before it passes through the scaleni muscles, if it should be found in a fit state; and 2dly, to tie the arteria innominata in case the former should be diseased or too much encroached upon by the aneurismal tumor.

Michael Bateman, aged 57 years, was born in Salem, Massachusetts, and by occupation a seaman. He was admitted into the New-York hospital on the 1st of March, 1818, for a catarrhal affection, having at the same time his right arm and shoulder much swollen. At the time of his admission the catarrh being thought the most considerable disease of the two, he was received as a medical patient, and placed under the care of the physician then in attendance. During the three first weeks of his residence in the house, the catarrh had greatly yielded to the remedies prescribed. The inflammation, which had produced an enlargement of the whole superior extremity, extending itself to the muscles of the neck on the right side, was also gradually subsiding.

A tumefaction, however, situated above and posterior to the clavicle, at first involved in the general swelling, and not to be distinguished from it, began to show itself. This resisted the remedies which were effectual in relieving the other, and became more distinct and circumscribed as the latter subsided, at length assuming the form of an irregular tumor.

The history which he gave of the case is as follows:—He said, about a week before he entered the hospital, while at work on ship-board, his feet accidentally slipped from under him, and he fell upon his right arm, shoulder, and the back part of his head; that he felt but little inconvenience from the fall, and after a short time returned to his duty. Two days subsequent to this, however, he felt pain in the shoulder, and the succeeding night was unable to lie up-

on it in bed. The whole arm and shoulder then began to swell, and became so painful that he was unable any longer to perform his duty as a seaman. The ship having arrived in New York, he was admitted into the hospital.

For some time after the general swelling had subsided, leaving the tumor distinct and circumscribed, no circumstance occurred which gave rise to a suspicion of its being aneurismal. The enlargement was thought to be a common indolent tumor, and was repeatedly blistered, with a view to discuss it. The tumor gradually diminished under this treatment; though a considerable time elapsed before any very striking change took place.

At length a faint and obscure pulsation was perceived; still it was a matter of doubt whether the tumor was aneurismal, or whether the pulsatory motion was communicated to it by the subclavian artery, immediately over which it was situated. From its firm unyielding nature upon pressure, the latter was considered as the most probable, and the blisters were continued as before. During the whole of this time the patient had worn his arm in a sling, the motions of it being very limited, and always attended with pain.

The patient remained in this state for several days, without any marked change either in his feelings or in the appearance of the tumor.

On the 3d of May, at 6 o'clock in the afternoon, the patient complained that he "felt something give way in the tumor," that his shoulder was very painful, and that he was able to raise it only a few inches from his side. The tumor at this time suddenly increased about one third, and a pulsation was distinctly perceptible. Its most prominent part was below the clavicle; at which place the pulsation was most distinct. The portion above the clavicle was also much enlarged; it still however had its usual firmness, except in one point near its centre.

May 4th.—The tumor is evidently increased, that portion of it more particularly which is below the clavicle; it is not as firm and resisting as it has been. Pulsation is not so distinct as yesterday, but appears to be more diffused.

He was this day transferred to the surgical side of the house, and became my patient. The cough having become comparatively slight, the tumor appeared to be the most urgent disease, and, in my opinion, to call for prompt attention. The arm is now perfectly useless, and any motion at the shoulder joint gives him severe pain. The patient is naturally of a spare habit, and from the nature of his disease, and the confinement to which he has been subjected, has become much reduced in strength.

May 5th and 6th.—The tumor is still progressing, and the pain in the shoulder is also more severe. During the three last days his medicines have been discontinued, except that he is allowed to rub the parts about the clavicle with volatile liniment.

On the 7th I directed a consultation of my colleagues to be called, consisting of Drs. W. Post, Kissam and Stevens. I now stated

to them that I wished to perform an operation which would enable me to pass a ligature around the subclavian artery, before it passes through the *scaleni* muscles, or the *arteria innominata*, if the size of the tumor should prevent the accomplishment of the former. This I was permitted to do, provided the patient should assent, after a candid and fair representation was made to him of the probable termination of his disease; and that the operation, though uncertain, gave him some chance, and, as we thought, the only one of his life.

Dr. Post, at my request, communicated with him privately on this subject, and after a full explanation of the nature of the case, my patient requested to have any operation performed which promised him a chance for his life, saying that in his present state he was truly wretched.

May 8th, 9th, and 10th.—The tumor is acknowledged by all to be increasing, and it is thought proper not to defer the operation any longer. I therefore requested that preparation be made for performing it to-morrow.

It is difficult to give an idea of the size of a tumor so irregular in its form, and so peculiarly situated. A thread passed over it, from the lower part of that portion of it which is below the clavicle, extending upward obliquely across the clavicle toward the back of the neck, will measure five and a quarter inches. Another crossing this at right angles one inch above the clavicle, will measure four inches; two and a half inches of the thread are on the sternal side of the former, and one and a half on the acromial. It rises fully an inch above the clavicle, which added to the depression below the clavicle on the opposite shoulder, will make the size of the swelling above the natural surface about two inches.

May 11th.—One hour before the time assigned for the operation, the patient appeared perfectly composed, and apparently pleased with the idea that the operation afforded him a prospect of some relief. He was directed to take of *Tinct. Opii*. 70 drops.

No difference can be perceived in the pulsation of the arteries in the two extremities; his pulses are uniform and regular, each beating 69 in a minute.

He was placed upon a table of the ordinary height, in a recumbent posture, a little inclining to the left side, so that the light fell obliquely upon the upper part of the thorax and neck. Seating myself on a bench of a convenient height, I commenced my incision upon the tumor, just above the clavicle, and carried it close to this bone and the upper end of the sternum, and terminated it immediately over the trachea; making it in extent about three inches. Another incision about the same length, extended from the termination of the first along the inner edge of the *sterno-cleido-mastoid* muscle. The integuments were then dissected from the *platysma myoides*, beginning at the lower angle of the incisions, and turned over upon the tumor and side of the neck.

Cutting through the *platysma myoides*, I cautiously divided the sternal part of the *mastoid* muscle, in the direction of the first inci-

sion, and as much of the clavicular portion as the size of the swelling would permit, and reflected it over upon the tumor. The internal jugular vein was encroached upon by the swelling, which made this part of the operation of the utmost delicacy, from the morbid adhesion of that part of the clavicular portion of the muscle to it, which was detached. I separated this portion of the muscle to as great an extent, however, as the case would possibly allow, to make room for the subsequent steps of the operation: only a part of the vein was exposed. The sterno hyoid muscle was next divided, and then the sterno-thyroid, and turned upon the opposite side of the wound, over the trachea. This exposed the sheath containing the carotid artery, par vagum, and internal jugular vein. A little above the sternum, I exposed the carotid artery, and separated the par vagum from it; then drawing the nerve and vein to the outside, and the artery towards the trachea, I readily laid bare the subclavian about half an inch from its origin. In doing this, the handle of a scalpel was principally used, nothing more being required but to separate the cellular membrane, as it covers the artery. I judged it would be very imprudent to introduce a common scalpel into so narrow and deep a wound, especially as it would be placed between two such important vessels or parts, as the carotid and par vagum, and where the least motion of the patient might cause a wound of one or the other of them. The proper instrument, in my opinion, for this part of the operation, is a knife, the size of a small scalpel, with a rounded point, and cutting only at the extremity; this was used, and found to be very convenient for this stage of the operation. It can be introduced into a deep and narrow wound, among important parts, without the hazard of dividing any but such as are intended to be cut. This knife is contained in a set of instruments admirably calculated for this and other operations on arteries deeply seated, and which I shall mention more particularly hereafter.

On arriving at the subclavian artery, it appeared to be considerably larger than common, and of an unhealthy colour; and when I exposed it to the extent of about half an inch from its origin, which was all that the tumor would permit, to ascertain this circumstance more satisfactorily, my friends concurred with me in opinion, that it would be highly injudicious to pass a ligature around it. The close contiguity of the tumor would of itself have been a sufficient objection to the application of the ligature in this situation, independent of the apparently altered state of the artery. Art in this case could not anticipate any thing like the institution of the healthy process of adhesive inflammation in an artery in the immediate vicinity of so much disease. The Pathology of arteries has long since taught us, that ulcerative inflammation, and all its train of consequences, would have been the inevitable result. This was the fate of the only case, in which a ligature has been applied to the artery in this situation. The operation was performed by that eminent Surgeon of Dublin, Dr. Colles.

While separating the cellular substance from the lower surface of the artery, with the smooth handle of an ivory scalpel, a branch

of artery was lacerated, which yielded for a few minutes a very smart hemorrhage, so as to fill the wound perhaps six or eight times. It was about half an inch distant from the *innominata*, and from the stream emitted, was about the size of a crow-quill. It stopped with a little pressure. I can scarcely believe this to have been the internal mammary, from the hemorrhage ceasing so quickly; though, from its situation, it would appear so, and if from some irregularity it were not the superior intercostal, it must have proceeded from an anomalous branch.

With this appearance of disease in the subclavian artery, it only remained for me either to pass the ligature around the arteria innominata, or abandon my patient. Although I very well knew, that this artery had never been taken up for any condition of aneurisms, and never in fact tied as a surgical operation, yet with the approbation of my friends, and reposing great confidence in the resources of the system, when aided by the noblest efforts of scientific surgery, I resolved upon the operation.

The bifurcation of the innominata being now in view, it only remained to prosecute the dissection a little lower behind the sternum. This was done mostly with the round edged knife, taking care to keep directly over and along the upper surface of the artery. After fairly denuding the artery upon its upper surface, I very cautiously, with the handle of a scalpel, separated the cellular substance from the sides of it, so as to avoid wounding the pleura. A round silken ligature was now readily passed around it, and the artery was tied about half an inch below the bifurcation. The recurrent and phrenic nerves were not disturbed in this part of the operation.

As most surgeons who have performed operations upon large arteries, in deep and narrow wounds, complain of the embarrassment which has attended the application of the ligature, I am happy in the present opportunity to have it in my power to recommend a set of instruments, contrived for the purpose, which, in my opinion, are calculated to surmount all difficulties. This set of instruments consists of several needles of different sizes and curvatures, with sharp and blunt points, and having in each two eyes. The needles screw into a strong handle or shank of steel: there are also two strong instruments in handles, with a ring or eye in the extremity similar to a tonsil iron, and perhaps they may be called ligature irons: a small knife rounded at the extremity like a lancet for scarifying the eyes, and a small hook at the extremity of a steel shank, also fixed in a strong handle. These instruments are the invention of Drs. Parish, Hartshorne, and Hewson, of Philadelphia. They are the result of investigations made upon the dead body, as to the best mode and place for tying the subclavian artery on the *acromial side* of the *scalenî muscles*.*

With the ligature introduced into the eye of one of the smallest blunt needles, which was nearest the shank of the instrument, I pressed down the cellular substance and pleura with the convex

* See Dr. Parish's Paper, Eclectic Rep., vol. III., p. 229.

part, and very carefully insinuated it from below upwards, under the artery. The point of the needle appearing on the opposite side of the artery, I introduced the hook into the other eye of it; then unscrewing the shank, the needle was drawn through with the utmost facility, leaving the ligature underneath the artery.

In the application of the ligature to this artery, I would invite the attention of those who perform it, to a circumstance which, in my opinion, is somewhat important: it is to pass the ligature from below upwards, in order to prevent the pleura from being wounded. From the use of these instruments repeatedly, I would also recommend that the hook be fixed in the eye of the needle before the shank is unscrewed, otherwise very considerable difficulty will be experienced in finding it, and even when felt, not easily introduced, from the want of firmness which the handle part of the instrument would afford.

I now made a knot in the ligature, and with my forefingers carried it down to the artery, and drew it a little so as partly to close its diameter and arrest the column of blood gradually. This was continued for a few seconds to observe the effect produced upon the heart and lungs; when no change taking place, it was drawn so as to stop the circulation entirely, as was shown by the radial artery of the right arm, and the right temporal immediately ceasing to pulsate. The knot was drawn more firmly by the ligature irons, and a second knot applied in the same manner.

In no instance did I ever view the countenance of man with more fluctuations of hope and fear, than in drawing the ligature upon this artery. To intercept suddenly one fourth of the quantity of blood, so near to the heart, without producing some unpleasant effect, no surgeon, *à priori*, would have believed possible. I therefore drew the ligature gradually, and with my eyes fixed upon his face; I was determined to remove it instantly if any alarming symptoms had appeared. But, instead of this, when he showed no change of feature or agitation of body, my gratification was of the highest kind.

Dr. Post now asked him if he felt any unpleasant sensation about his head, breast, or arm, or felt any way different from common, to which he replied, that he did not.

Immediately after the ligature was drawn tight, the tumour was reduced in size about one third, and the course of the clavicle could be distinctly felt.

The parts were now brought into coaptation, and the integuments drawn together by three interrupted sutures and straps of adhesive plaster; a little lint and additional straps completed the dressing. Three small arteries were tied in the course of the operation: the first was under the sternum, and divided with the sternal part of the mastoid muscle, and from its course may have been a branch of the internal mammary reflected upwards; the second, in raising the inner edge of the mastoid muscle, about the upper angle of the longitudinal incision, and must have been the most descending branch of the superior thyroid; and the third, was a

branch of the inferior thyroid, and cut while raising the sterno thyroid muscle. The patient lost perhaps from two to four ounces of blood, most of which came from the ruptured branch of the subclavian. The operation occupied about one hour.

The curved spatulas recommended by Dr. Colles, I found of great use in the operation. I provided three for this purpose; two broad, and one narrow, bent at right angles, and sufficiently firm. After raising the muscles, they were of the greatest advantage in keeping separated the carotid artery and par vagum, as likewise the divided muscles; they served also another very useful purpose, that of preventing by their equable pressure the constant oozing from the smaller vessels; and the little room taken up in a small and deep wound, will give them a great superiority over the fingers introduced.

Ten minutes after the operation the pulse is regular, and not the least variation can be perceived; it beats 69 strokes in a minute; the patient says he is perfectly comfortable, and has no new or unnatural sensation, except a little stiffness of the muscles of the neck, which he thinks is owing to the position in which his head was placed during the operation; the temperature of the right arm is a little cooler than the left; his breathing has not been the least affected by the operation, but is perfectly free and natural.

2 o'clock, P. M.—Patient expresses a desire to eat, and is directed a little thin soup and bread; the temperature of both arms is very nearly the same; breathing perfectly natural; pulse as before.

3 o'clock, P. M.—There is still a trifling difference in the temperature of the two arms; ordered the right to be wrapped in cotton wadding; not the least unpleasant symptom has as yet made its appearance.

6 o'clock, P. M.—Complains of a little pain in his head, not more on one side, however, than the other; describes it as a common head-ache: the pain of the shoulder and arm much less than before the operation: no difference can now be perceived in the temperature of the two arms; pulse a little accelerated, and perhaps a little full.

9 P. M.—Patient complains of head-ache; skin is rather hotter than natural; pulse strong and full, and beats 75 in a minute; the carotid on the left side of the neck is observed to be much dilated and in strong action; tongue moist and clean.

9½ P. M.—Symptoms continuing the same, directed him to be bled from the left arm to ʒ xvj. After bleeding the pulse fell 7 beats, and was less full. Complains of some thirst; let him drink common tea.

12 P. M.—Patient has slept a little; is free from pain; pulse full and less frequent, beats 60; skin moist and of a natural temperature.

Second day, 2 o'clock, A. M.—Patient enjoys a natural and undisturbed sleep; respiration free, and performed without the least difficulty.

5 A. M.—He has rested well the last three hours. Says he has

a slight head-ache, and a little pain in the right elbow : the latter he attributes to the position in which his arm has lain during sleep ; pulse full, but not so tense as before the venesection ; skin natural and moist ; temperature of both arms the same. He states that he can now incline more upon the shoulder than he has been able to do since the second day after he received the injury.

9 A. M.—Pain in the head no way troublesome ; skin moist and of natural temperature ; tongue clean ; says his neck feels stiff, but is not painful ; has no difficulty in swallowing. His cough has thus far been much less frequent than before the operation : expectoration is also attended with less difficulty ; pulse 75, full, but not tense ; has taken a dish of coffee, and some bread ; complains of some thirst ; directed a solution of supertartrate of potass to be drank occasionally.

10 A. M.—Symptoms as before ; the veins of the fore-arm and hand since the operation have been as much distended as previous to it, and upon compressing them so as to stop the circulation, and allow the vein to become empty for some distance above, the column of blood is seen to distend the vein immediately upon the removal of the pressure, plainly showing that the circulation is going on with considerable rapidity, although no pulsation has been felt in the brachial or radial arteries. The radial artery can be easily distinguished by the fingers, and seems to be filled with blood. There is evidently a pulsation in the anterior branch of the temporal artery, just as it is passing a little above the exterior canthus of the orbit ; the left external carotid is beating with increased action, and appears larger than natural.

3 P. M.—Has taken a light dinner, and complains of a little head-ache ; pulse has become tense, and is also increased in frequency ; skin is considerably hotter than natural ; tongue too indicates a febrile action : was bled to $\frac{3}{4}$ viij., and directed to drink freely of a solution of the supertartrate of potass.

10 P. M.—Since the last report he has become more comfortable ; complains of no pain, and says he lies perfectly easy ; pulse increased in frequency to 78, but of the natural soft feel ; the right side of the face has been at times a little cooler than the left, and is so at the present time : it is however, not so much so as to be perceptible to the patient ; temperature of the right arm natural ; that of the left, and the whole body, is above the natural standard, but it is moist ; tongue is clean : having had no evacuation from his bowels since the operation, is directed to take a saline cathartic, in divided doses.

1 A. M.—Complains of nothing ; has not slept any ; cathartic has operated twice.

Third day, 5 A. M.—Has had no sleep in consequence of the operation of the medicine, it having produced free evacuations in the course of the night ; skin not so moist, but of natural temperature ; the two arms have equal warmth ; pulse full, and rather more frequent than last evening : says his right elbow is a little painful, and the arm feels tired. The complete flexion of the arm

at the elbow is prevented by a little rigidity of the extensor muscles.

9 A. M.—He is now comfortable, has slept a little, and feels refreshed; pulse is full, and rather more frequent than natural; skin natural and moist: the size of the tumour is considerably diminished; has taken a dish of chocolate and some rusk.

11½ A. M.—Patient still free from pain, or any uneasiness; medicine has operated seven times; skin not hotter than natural, and moist; tongue clean; the right facial and anterior temporal arteries communicate a distinct pulsation to the fingers: having slept but little during the last night, directed him to take an anodyne of Tinct. Opil. gtt. xxx., and to have the room made dark, and kept quiet, in order to procure him some sleep: let him have sago or panada as often as he inclines to take nourishment.

4 P. M.—Has slept the last two hours, and is still sleeping; respiration free and easy; nothing the least unnatural in his appearance.

10 P. M.—He has slept four hours, and is much refreshed; is free from pain, except a little in the elbow; pulse small and soft, beating 105 strokes in a minute; tongue clean; feels a little soreness in the wound when swallowing; has taken a considerable quantity of sago and panada; his appetite is good; temperature natural and uniform in both arms.

12 P. M.—Patient has slept the greater part of the time; is free from pain, and perfectly comfortable; skin moist and natural; pulse soft, small, and frequent.

Fourth day, 6 o'clock, A. M.—Patient has passed a good night; says his right elbow gives him some uneasiness, but complains of nothing else; tongue is clean; skin moist and natural; can move the right arm with considerable ease: says he takes as much light nourishment as he has been accustomed to for some time past: no unfavorable symptom has as yet made its appearance.

11 A. M.—Symptoms continue much the same; tongue slightly furred; pulse comparatively small and soft, beats 105, and regular; respiration has been uniformly natural since the operation; suppuration has begun to appear through the dressings, and is attended with a little fœtor; let them be covered with a yeast poultice: it is thought that a faint pulsation or undulation is at intervals felt in the radial artery of the right arm: the left external carotid continues its increased action.

6 P. M.—No change is observable in the patient's symptoms; he still continues comfortable and complains of nothing.

Fifth day, 11½ o'clock A. M.—The wound was dressed to-day: on removing the poultice the dressings were soft and easily came away; the suppuration was considerable, and of a healthy appearance; it was found that the extremities of the two incisions were united as far as the sutures, each about one inch in extent; one suture at the angle of the wound was removed; the wound was dressed with dry lint, gently pressed into it; adhesive straps

and a compress: his pulse beats 110, is fuller and stronger than yesterday.

6 P. M.—Patient is very comfortable, subject to no pain or unnatural sensation; pulse still 110, but softer.

Sixth day, 6 A. M.—Patient sleeps; respiration not attended with the least difficulty; skin moist and natural.

9 A. M.—He has rested well during the night, and is perfectly free from pain; pulse 110, and soft; skin moist; tongue clean: having had no alvine evacuation since the 13th, directed to take of sulphate of soda $\mathfrak{z}\text{j}$, in divided doses.

11 A. M.—The dressings were again removed, and the discharge seemed more considerable than at the former dressing; the sides of the wound are granulating, and appear perfectly healthy; on the ends of the muscles that were divided in the operation, there are small sloughs which are beginning to separate, leaving a healthy surface underneath: wound was dressed with lint spread with Ung. Res. Flav. and adhesive straps: pulsation is now perfectly distinct in the branches of the right external carotid artery: complains a little of the back part of his head, which he says is sore from lying; in other respects is comfortable.

6 P. M.—Has no pain, and is in every respect much as usual; tongue clean; skin natural; says he feels “no weaker than before the operation.”

Seventh day, 6 A. M.—He has passed a comfortable night, and is free from pain or any uneasiness; pulse regular and soft, and beats 105 in a minute; skin moist, and of natural temperature.

11 A. M.—The wound was again dressed: suppuration considerable and healthy; some of the small sloughs came away, leaving a healthy and florid surface beneath: sprinkled the wound with powdered carbon, then filled it lightly with lint, and over this applied the yeast poultice, which was secured with adhesive straps: temperature of the two arms is the same, cathartic having produced no effect; *habeat enema purgans statim*.

9 P. M.—Symptoms have not varied materially; the enema has produced a copious evacuation: says he feels more comfortable, and desires to set up in bed, which was allowed, taking care to have him raised up very cautiously, in order to prevent any exertion being made with the right arm and shoulder.

Eighth day, 6 A. M.—Patient has rested well during the night; says he feels some pain on swallowing, and that when the attempt is made, it gives rise to a fit of coughing, which fatigues him; it also occasions some soreness in the wound: pulse still soft, and less frequent than yesterday: he takes a reasonable quantity of light food every day:—Directed a cetaceous mixture for his cough, and is permitted to set up for a short time, if he feels disposed.

11 A. M.—Pulsation of the radial artery of the right arm to be felt occasionally pretty distinct; cough has become more troublesome; pulse 100; skin natural and moist. The dressings were again removed, and the suppuration is more profuse, apparently

healthy, though attended with considerable fœtor; appearance of the wound every way favorable; small portions of the sloughs are removed at each dressing, and the sides of the wound look perfectly healthy; the same dressings to be continued.

9 P. M.—Complains only of his cough, which troubles him frequently; can move his arm with much more facility, and has no pain in it; circulation as before, and the temperature uniform and natural. The wound was dressed this evening in consequence of the fœtor being unpleasant to the patient; continue the dressings.

Ninth day, 7 A. M.—Patient was found sitting up in bed, supported by a bed-chair, having passed a good night; is in good spirits, and expresses his gratitude for the relief afforded by the operation; says he can move the arm with greater ease, and it gives him no pain; pulse 105, regular and soft; skin natural; every symptom as favourable as could be wished.

10 A. M.—Pulse less frequent, regular and soft; temperature perfectly natural; wound has a more favourable appearance, discharges less in quantity, and it possesses less fœtor; dressed the wound as yesterday; tumour has diminished two thirds, is soft, and less florid. The apex of the tumour is now below the clavicle.

6 P. M.—Patient still in every respect as comfortable as at the last report.

9 P. M.—Pulse 110, regular and soft; the dressings were removed this evening; the wound is much contracted in size, and is perfectly healthy, except a small slough which still remains in the deepest part of the wound; granulations are shooting up rapidly from the sides. When preparing to remove the dressings, an unexpected and unaccountable hemorrhage took place, which suddenly filled the cavity of the wound. The rapidity with which the blood flowed, and the size of the stream, gave rise to fearful apprehensions for the man's safety: dry lint was immediately placed in the wound, and as much pressure made as the patient could conveniently bear, which quickly stopped it. After continuing the pressure for a short time, the lint was removed, when no hemorrhage recurring, the usual dressings were repeated: the patient experienced no ill effects from the bleeding, nor did he seem to be much agitated. At 10 o'clock, P. M., has no pain, nor has he as yet had any sleep.

Tenth day, 7 A. M.—Has passed a comfortable night, except that he has been frequently disturbed by his cough: tongue clean; skin moist; pulse soft, and has much less strength than before.

11 A. M.—The dressings were again removed, and the wound made clean; its appearance is in every respect favorable; does not appear to have been the least injured by the hemorrhage; the dressings were renewed as before: he is directed to take half an ounce of the cold infusion of cinchona every hour, and to drink occasionally of ale when thirsty: has had an evacuation from his bowels to-day.

6 P. M.—Symptoms much as before; complains a little of his

elbow, and a numbness in his hand, to relieve which he is directed to have the arm and hand rubbed well, and wrapped in wadding.

Eleventh day, 6 A. M.—Patient has rested well during the night; cough has not been so troublesome; says he has no pain, and feels perfectly comfortable; pulse better than yesterday; other symptoms as before.

11 A. M.—The wound is dressed daily at this hour; its appearance is still very favorable, although there is still some fœtor in the suppuration: the wound has contracted perhaps one third: the tumor is also considerably diminished, and softer than before; pulsation in the right temporal and radial arteries as before: the same dressings to be continued.

6 P. M.—No change in the patient's general symptoms; pulse soft, and rather more frequent; appetite is as good as usual.

9 P. M.—Appearances have not varied.

Twelfth day, 6 A. M.—Our patient was visited as usual this morning, but there is no evident change in any of his symptoms; says he now rests well at night.

11 A. M.—To-day, when the dressings were removed, that portion of the slough which occupied the bottom of the wound (apparently a portion of the sheath of the vessels) came away: every part of the wound now, where its surface can be seen, has a healthy look; the most depending part is obscured by a quantity of pus, which cannot be wholly removed by lint, and it is not thought safe to permit the patient to lie in such a position as will allow it to be discharged: with the slough came away the ligature which had been applied to an artery under the lower portion of the sternothyroid muscle; it was followed by no hemorrhage; the wound was now dressed with pledgets of lint, spread with Ung. Resinæ Flavæ and adhesive straps. He remains much as yesterday, has drank freely of ale; pulse rather stronger than yesterday.

Thirteenth day, 7 A. M.—No perceptible change in his symptoms; complains of no pain, and says he feels very comfortable; cough has given him very little trouble for the last two days; he is evidently considerably weaker than before the operation, but is not sensible of it himself.

11 A. M.—The wound was again exposed; it is not as florid as yesterday, and there is a greater secretion of pus; the cavity of the wound was filled with dry lint only; the pus appears well formed, and has very little fœtor.

The same dressings were repeated in the evening; there is still a quantity of pus at the bottom of the wound, which rises and falls at each inspiration and expiration: it continues to contract above, leaving us uncertain of its extent beneath: during the last three days, the patient has set up for several hours each day.

9 P. M.—Pulse and skin perfectly natural; has had a natural evacuation from his bowels to-day; continues the infusion of bark as prescribed before.

Wound was again dressed, and is as healthy as usual; suppura-

tion just sufficient to moisten the lint: the same dressings to be continued.

Fourteenth day, 7 A. M.—Patient has slept well during the night, and is as well as usual; complains of soreness of an ulcer which he has had for some time between his shoulders; it is improving in its appearance, and is directed to be dressed as usual with Ung. Resinæ Flavæ. The erysipelatous blush which surrounded it, is not as florid as heretofore; it is beginning to granulate, and assume a healthy appearance: in other respects he is perfectly comfortable: he is now able to raise the right arm to his lips, which he has not done since the fourth day after the accident by which his shoulder was injured; says too that he is getting stronger, and that he walked across the floor this morning without any assistance.

11 A. M.—On removing the dressing, the granulations appear perfectly florid and healthy: the bottom of the wound is not visible, owing to the small quantity of matter which collects there, and from its depth cannot be easily removed, and perhaps not altogether safely; the position of the patient in bed must necessarily make the bottom of the wound the lowest: when he coughs or swallows, a small quantity of fluid pus at the bottom of the wound is seen to rise and fall; from the general appearance, however, of the wound, the man's feelings, and many other circumstances, it is not probable that there is any considerable quantity: the large ligature lying very loose in the wound, was taken hold of, merely however to see if it was separated; no force was used: pulsation of the right radial artery more distinct than heretofore: countenance of our patient is improving; says he feels more comfortable than before the operation: he can now straighten his arm, and raise it to his mouth with facility: as yet he has not recovered his strength, but is improving daily; has been setting up all day: directed him when lying down, to assume a more recumbent posture; continues the sulphuric acid and infusion of cinchona, as before; complains of the ale being too strong; let it be diluted and made pleasant with sugar and nutmeg.

9 P. M.—The large ligature since the operation, has been confined upon the upper part of the sternum by a piece of adhesive plaster, to prevent any accident during the dressings. Upon dressing the wound this evening, the large ligature as it lay in the wound, appearing to be loose, was again taken hold of with the forceps, and found floating upon the pus, being completely separated from the artery below. The ligature was drawn so firmly upon the artery, that the noose was only large enough to admit the rounded end of a common probe. The wound looks healthy, and is contracting rapidly; it is now perhaps not more than one third of its original size. Suppuration is now only sufficient to moisten the lint through.

Fifteenth day, 12 o'clock.—The patient is comfortable in every respect; pulse and skin perfectly natural; is sitting up in bed, and occasionally amusing himself with a book; not the least symptom about him indicating indisposition: wound is healthy, and con-

tinues to improvè in appearance. The right arm at intervals gives him a sensation of numbness,—not more, however, than can be accounted for from the uniform position in which the arm rests, and no doubt a more languid circulation, as it is readily removed by a little friction and motion of the arm. His appetite improves, and he expresses a desire to walk about the room. The bark and sulphuric acid to be continued.

9 P. M.—In the afternoon he was removed down stairs, from the private room in which he was placed immediately after the operation, to the ward in which he formerly lay, and appeared highly gratified with the idea of again seeing his friends, whom he had left with very little hope of ever returning to. The wound, upon being dressed, did not appear to have undergone any perceptible change.

Sixteenth day, 11 A. M.—Our patient's strength is improving. To-day he made an effort, and with success, to visit his friends in Ward No. 7, where he lay previous to his being transferred to the surgical department, and returned, without having any support; pulse as strong as before the operation, and in every respect natural; appetite better than before the operation; cough a little troublesome, but less so than for several days previous; wound dressed with dry lint.

9 P. M.—Dressings removed; patient as before; suppuration small in quantity, and appears to be well-formed pus, and is not attended with the least fœtor.

Seventeenth day, 11 o'clock.—The ends of the divided muscles are nearly in contact, and the surfaces of the wound are rapidly granulating, and in every respect look well: patient's health continues to improve; he walks about the room with perfect ease, and into several wards in the same story; the ability to move the arm increases; pulse and skin natural. The dressings were removed at 4 P. M., and also at 10 P. M.

Eighteenth day.—The patient's strength continues to improve; every symptom remains highly flattering; cough less troublesome. The dressings were again removed to-day three times.

Nineteenth day.—Continues the same as yesterday; wound dressed three times.

Twentieth day.—To-day he passed down two pair of stairs, and walked several times across the yard, and was highly delighted with his performance, and felt not the least inconvenience from it; sleeps uniformly well during the night, and takes more food during the day than he did previous to the operation; continues the infusion of cinchona and sulph. acid as before, and directed to use dry lint as the dressing.

Twenty-first day.—Dressed the wound three times again to-day; it is nearly closed at the bottom; the power of motion in the right arm continues to increase: he can now move it with as much facility as the left, though not to the same extent: his strength is daily improving, and the operation is considered by all to have been completely successful; size of the tumor continues the same, no diminution of it having been perceived for the last week; the most

prominent part of the tumor is yet below the clavicle, that above rises to about the height of the clavicle, which gives a little convexity to the place between the clavicle and trapezius muscle.

Twenty-second day.—Continues to improve in every respect; dressings renewed as often as yesterday; owing to the weather he has not left his ward to-day; pulse full and strong; temperature of both arms the same.

Twenty-third day.—A few minutes before the hour of visiting to-day, a message was brought that the patient was bleeding from the wound. The dressings were immediately torn off, and dry lint crowded into the wound, and slight pressure applied for a few minutes, when the hemorrhage ceased. The patient lost at this time, perhaps about 24 ounces of blood, and was very much prostrated. Pulsation ceased in the radial artery of the left arm, and the countenance, gasping, and convulsive throes of the patient, threatened immediate dissolution; all present apprehended the instant death of the patient. The first impression was, that the trunk of the *arteria innominata* had given way. The conjecture afterwards was, that the subclavian artery, from the diseased state of it, had not united by adhesion, and that the fluid blood from the tumor had regurgitated through its ulcerated coats. This appeared to be the most probable, both from the suddenness with which the blood ceased flowing, and the cause the patient assigned for the hemorrhage. He says that he felt weary of lying on his left side and back; that he had just turned on the right, which he had not done before since the operation, agreeable to my request. At the instant of turning over, something arrested his attention, which caused him to turn his head to the opposite side suddenly, and he felt the gush of blood from the wound.

He was directed some wine and water frequently, which soon revived the circulation. The wound was dressed with dry lint and a compress. Pulse as frequent as natural, but very small and soft: he appears very languid, and complains of a numbness and painful sensation in his hands; says also that his back aches. During the last twenty-four hours he has taken a pint and a half of Madeira wine: he also took occasionally some egg and wine, which was immediately rejected from the stomach.

9 P. M.—Patient has lost his appetite, and appears considerably depressed; circulation very languid in the right arm; its temperature is a little less than in the left: directed a hot brick to be wrapped in flannel, and placed close to the arm. For a profuse perspiration which he has been in for the last three hours, he was ordered to be bathed with cold rum.

Twenty-fourth day, 6 A. M.—Slept the greater part of the night, and feels comfortable; is still languid, and has no disposition to eat anything; says he feels sick, and once last evening vomited after drinking some wine and water.

Wound looks exceedingly pale, and the discharge is thin and *fœtid*, for which the carbon and yeast dressings were applied. He has vomited several times to-day, and has some considerable dif-

ficulty in swallowing, and complains of a soreness in the wound upon pressure.

9 P. M.—Dressings removed; wound very pale; right arm of the natural temperature; feels occasionally a little numbness in the hand; has taken very little nourishment during the day, pulse natural as to frequency, but small and feeble; a few minutes after dressing the wound, information was brought that hemorrhage had ensued, and before it could be commanded, he probably lost four ounces of blood. For his restlessness and pain in the bones he was ordered two grains of opium.

Twenty-fifth day.—Has rested well during the night, and is perhaps a little better this morning. The repeated hemorrhages have debilitated him exceedingly, and from the irritable state of the stomach, he can take only a very little nourishment. In the morning he was directed the effervescing draught to be repeated every two hours; this allayed the irritability of his stomach, and enabled him to take a little breakfast.

His countenance has altered since the first bleeding surprisingly, his eyes are now heavy, and for the most part fixed; his cheeks are sunken, and an universal pallor has spread itself over his countenance; and from every appearance, a short time will terminate his existence. He has not vomited since early in the morning; is advised to take a little soup, and to drink freely of wine and water; dressings were renewed at 3 o'clock, P. M., shortly after which the patient again bled, but not to exceed, however, an ounce. He was dressed with dry lint as usual.

11 P. M.—Patient has not as yet had any sound sleep, is restless and apparently distressed, although he says he feels no pain; breathing is attended with some difficulty; his hands and legs are continually in motion; pulse small and feeble.

Twenty-sixth day, 6 A. M.—Patient has not rested well; is occasionally falling into little slumbers, but is awakened by the least motion: pulse small and feeble; respiration somewhat laboured; appears to be sinking; seems disinclined to take any thing; legs and arms constantly in motion.

11 A. M.—More feeble than before; has been forced to take a little chocolate; is evidently sinking; wound was dressed, but there was no secretion of pus in it; countenance of the patient foretels his approaching dissolution.

6 P. M.—Is extremely low; respiration very much laboured; is not able to articulate: for the last three hours there has not been such continued throwing of the legs and arms about the bed: he lies in a state of insensibility; *temperature of the two arms the same to the last.* My pupil, Abraham I. Duryce, the House Surgeon, (to whom I am indebted for the correct reports, and the most unwearied attention to this case, and whose ingenious application of means for the recovery of many of my patients, will long be held by them in grateful remembrance,) having for a few minutes left the patient, he was sent for immediately, as there was another bleeding from the wound, by which he lost probably eight

ounces of blood : during the whole time he did not manifest the least appearance of consciousness, nor was the least motion perceptible, except that necessary for respiration and circulation : the hemorrhage was stopped with lint, after removing the former dressings ; respiration is now performed with the utmost difficulty, and the patient appears as if every respiration would be the last : he expired at half past six in the afternoon : the temperature of the right arm after death, appeared by the touch to be the same as that of the left ; it was as natural and uniform as in other parts of the body.

EXAMINATION OF THE BODY.

About eighteen hours after death, I opened his body ; there was considerable emaciation, and the surface of the wound was of a dark-brown color, and fœtid ; the wound was perhaps about one-third of its original size ; it had been enlarged by the pressure of lint into it, and other means to arrest from time to time the hemorrhage : the ulcer between his shoulders was ill-conditioned.

For the purpose of examining the condition of the aorta, where the arteria innominata is given off, as also the origin of the latter vessel, as well as the state of the pleura at the part about which the ligature had been applied around the artery, the chest was opened in the following manner : after removing the integuments and muscles from the fore-part of the chest, the sternum was carefully sawed through about an inch from its upper extremity, and raised by sawing through the ribs below the junction of the cartilages ; this removed so much of the front part of the chest as to facilitate and expose fully to view the subsequent steps of the dissection ; by thus leaving the clavicles attached, every part connected with the ulcer and great vessels could be seen and examined in situ.

The arch of the aorta and origin of the innominata being fairly exposed, not a vestige of inflammation or its consequences could be discovered, either upon them, the lungs, or the pleura, at any part. An incision was next made longitudinally into the aorta opposite the origin of the innominata, and upon introducing a probe cautiously up the latter vessel, it was seen to pass into the cavity of the ulcer ; the innominata was then laid open with a pair of scissors into the ulcer ; the internal coat of this vessel was smooth and natural about its origin, but for half an inch below where the ligature had cut through the artery, it showed appearances of inflammation, and there was a coagulum adhering with considerable firmness to one of its sides ; showing that nature had made an effort to plug up the extremity of so large a vessel, after the adhesion, which no doubt had been effected by the ligature, was swept away by the destructive process of ulceration. The upper extremity of this vessel was considerably diminished in its diameter by the thickened state of its coats, occasioned by the surrounding inflammation. The innominata about half an inch from the aorta, and a little to the left side, gave off an anomalous artery large enough to admit a small sized crow-quill.

The ulcer at the bottom was more than twice the size of the wound in the neck; it extended laterally towards the trachea and under the clavicle towards the tumor. The tripod of great vessels, consisting of the innominate, subclavian, and carotid arteries, to the extent of nearly an inch, was dissolved and carried away by the ulceration. The extremities of the two latter vessels were found also to open into the cavity of the ulcer. The upper surface of the pleura was very much thickened by the deposit of newly organised matter, for the safety and protection of the cavity of the thorax. Indeed, instead of having increased the danger of penetrating this membrane, the adhesive inflammation which preceded the ulcerative, seemed, by the consolidation of cellular membrane, and the addition of new substance, to have more securely and effectually shielded it from harm.

The internal surface of the carotid artery was lined with a coagulum of blood, more than twice the thickness of its coats, and extending above the division into the internal and external, so as almost to give them a solid appearance, insomuch that a probe could barely be introduced. The subclavian artery, internally and externally to the disease was pervious. The brachial and other arteries of the right arm were of their common diameter, and in every respect natural. The external thoracic or mammary arteries, as they went off from the subclavian, were larger than natural: the right internal mammary was pervious, and of the usual appearance. Upon opening into the tumor, which now gave (from its small size,) no deformity to the shoulder, the clavicle was involved in it, and found carious, and entirely disunited about the middle. Several coagula of blood were also found in the sac. A number of lymphatic glands under the clavicles, and particularly the left, were considerably enlarged, and, when cut into, very soft, and evidently in a state of serofulous suppuration. No other morbid appearances were observed.

SEVERAL very important facts are established by this operation—facts which no surgical operation has ever before confirmed. It proves very conclusively, that the heart, the brain, and the right-arm, were not the least injured by it, in any of their functions. To tie so large a vessel, so near the heart, might very reasonably be expected to occasion some immediate derangement in the actions of that organ: but it was neither increased nor diminished in its contractions, nor did it give rise to the least visible change in the respiration. All this could not have been anticipated. I apprehend there are no ingenuous surgeons, who would not have expected quite a contrary result. For my own part, I must confess, that this was to me an anxious moment, when I drew the ligature upon this artery. Indeed, so apprehensive was I that some serious, if not almost immediately fatal consequences, would follow, from arresting so large a proportion of the whole mass of blood suddenly, that I drew the ligature very little at first. But when no change took place in the action of the heart, or respiration, I felt a confidence in completely intercepting the whole current of blood through this great vessel.

The brain in no operation has been deprived of so large a quantity of blood as in this, and yet it suffered no inconvenience : from the effect of experiments however upon animals, I entertained no fear as to the consequences of my operation upon this organ.

The right arm, as the reports of the case from day to day will show, was in no want of a sufficient supply of blood for the purposes of its economy. That circulation went on to a degree adequate to its wants, the natural warmth and function of the skin fully prove ; and although at no time could all be satisfied that a pulsation was perceptible in the radial artery, yet many at times were of the opinion that an occasional undulatory motion was very evident ; every one was confident of the distended and elastic feel of this artery, and could plainly see, from pressing on the distended veins upon the back of the hand, that a free circulation of blood was going on : but independent of these evidences, the natural warmth and free perspiration would alone be sufficient to establish the fact.

The route of circulation to the right arm, was somewhat different at first, from what took place after the ulceration had extended. The inosculation of the epigastric and internal mammary must have thrown a considerable retrograde current of blood through the lat-

(Plate I.)



Represents the tumor very correctly, with its elevation above and below the clavicle, and the extent of it towards the acromion scapulae, and likewise as it encroached upon the trachea. The form of the external incision with the subsequent steps of the operation, as far as can be given in a drawing, are also shown.

a, a, a The angles of the integuments as turned over upon the tumor.

b The sternal and a part of the clavicular portion of the sterno-cleido mastoid muscle, raised, and reflected over upon the integuments.

c The sterno-hyoid muscle laid over upon the trachea.

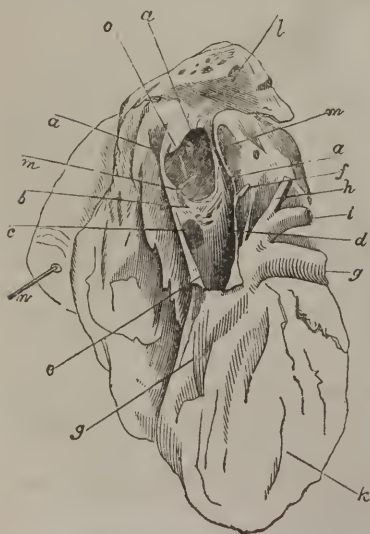
d The sterno-thyroid muscle also raised and reflected inwards over the trachea.

ter vessel into the subclavian directly, and which in all probability passed on into the arm; after the ulceration had extended, this communication was cut off by the destruction of the subclavian to some distance. It was now that the principal supply of blood to the arm must have been derived from the free communication of the intercostals with the thoracic arteries. From the large size of these, as found in the dissection, I apprehend they must have afforded the principal channels through which the blood was conveyed to the arm after the operation: the anastomoses of the infra-scapular and other arteries of the axilla, more or less with small branches of the intercostals, as also the occipital, with small ascending branches from the subclavian, may have given some trifling assistance.

The ulceration which went on so insidiously at the bottom of the wound, was the sole cause of the death of my patient. While the upper part of the wound put on a favorable appearance, and seemed healing, mischief was extending below. The separation of the ligature on the fourteenth day, spontaneously, without being followed by any hemorrhage for a number of days, and not until ulceration had extended, conclusively proves to my mind, that all the purposes of the ligature were completely answered—that adhesion was fully effected. Had it not been for the ulcerative inflammation, no doubt will be entertained, I think, by surgeons, but that my patient would have recovered. From occupation his constitution was indeed very old, and with an ill-conditioned habit, every thing favored the process of ulceration. The position of the wound may be said by some to favor this process, but in a sound healthy habit it would only retard the wound in its recovery, but would never promote ulceration.

The practicability and propriety of the operation appear to me

(Plate II.)



Exhibits the morbid appearances which were found upon dissection.

a, a, a View of the ulcer as it extended under the clavicle, and towards the trachea.

b The upper part of the arteria innominata, about which the ligature had been applied, appearing rough and irregular from the erosion of the ulcer.

c A coagulum of blood adhering pretty firmly to one side of the innominata.

d Contracted and puckered appearance of the upper part of the innominata, and particularly of its internal coat.

e Arteria innominata cut open from the aorta.

f Anomalous branch of the innominata.

g, g The aorta.

h Left Carotid.

i Left subclavian. *k* The heart collapsed.

l Sternum and clavicle turned up.

m, m Pleura much thickened.

n Probe introduced into the axillary artery, passed through the subclavian, and appearing in the cavity of the ulcer.

o A small bougie passed along the common carotid, and its extremity also seen in the ulcer.

to be satisfactorily established by this case : and although I feel a regret, that none can realize who have not performed surgical operations, in the fatal termination of it, and especially after the high and just expectations of recovery which it exhibited ; yet I am happy in the reflection, as it is the only time it has ever been performed, that it is the bearer of a message to Surgery, containing new and important results.

No. II.—Nov. 14, 1818. THE RIGHT CAROTID TIED FOR THE SAFE REMOVAL OF A FUNGOUS TUMOR IN THE NECK, BY VALENTINE MOTT, M. D., &c. (See the Medical and Surgical Register, consisting chiefly of Cases in the New York Hospital, New York, 1820, part II., vol. I., p. 381–400, with three Plates and Explanations at p. 405–6 of the same work. The same is published also in *The American Journal of the Medical Sciences*, with the same plates, Philadelphia, 1831, vol. VIII., p. 45, &c.)

John McGarrigle, born in Ireland, aged forty-nine years, a mason by occupation, was admitted into the New York hospital on the 10th of November, 1818, for a carcinomatous fungus.

The fungus was situated upon the right side of the face and neck, and occupied a considerable portion of each. It extended from the inferior lobe of the ear nearly to the chin, and downward to a horizontal line, passing through the inferior edge of the thyroid cartilage.

It projected downward and forward, to the extent of about four inches.

At its most prominent part, there was an opening, nearly circular in its form, and about one and a half inches in diameter ; gradually diminishing as it extended through the fungus, and terminating just within the margin of the inferior maxillary bone.

The edges were everted, and studded round with clusters of fungous excrescences, varying in size from that of a pea to a marble ; of a pale red colour, and of a granulated appearance ; extremely flabby in their structure, and bleeding upon the slightest touch.

From its cavity there was a constant discharge of a thin acrid fluid, amounting to about a pint in twenty-four hours ; extremely offensive, and excoriating the surface with which it happened to come in contact.

He seems to have been originally a man of a strong and vigorous constitution, but at the time of his admission, it had suffered much from the disease. His countenance was pale ; pulse feeble ; he had no appetite, and his whole appearance evinced the utmost languor and depression.

About eight months previous to the appearance of this tumor, he had been cured of an ulcer situated on his lower lip, that had troubled him more than two years. He says it resembled a wart, that at times it gave him severe pain, and that he had tried various applications without deriving any benefit, until a cancer doctor

gave him a "burning plaster," which brought out the core, and then it soon got well.

The patient ascribes the origin of his disease to a severe tooth-ache, which was attended with a swelling of that side of his face, in April last. When the swelling subsided, he discovered a small moveable tumor, very little larger than a pea, immediately under the margin of the lower jaw. It remained nearly stationary for two months, giving him but little pain and no inconvenience. It then began to swell, and became troublesome; the pain was severe, and of that peculiar kind which characterizes carcinoma. He was advised by his physician to apply poultices, which were continued for five or six weeks. The tumor was then punctured with a lancet. A little bloody serum alone flowed from the puncture.

Shortly after this, the tumor began to increase with more rapidity; two other openings formed spontaneously, which soon communicated with the first, making the large circular opening before described.

In consultation it was agreed, that an operation which would lessen the flow of blood to the fungus, and permit as much of the tumor to be removed as possible, afforded the only possible means of prolonging the existence of the patient, or of mitigating his sufferings. With these views, I accordingly performed the following operation, on the 14th day of November, at 12 o'clock.

The right carotid was taken up about an inch below the cricoid cartilage, and secured by two ligatures, but not divided in the interspace, in consequence of the depth of the artery, from the swelling of all the parts around the disease. Such was the enlarged size of the vessels, that it became necessary to take up several arteries and veins before the carotid could be exposed.

The tumor was removed by an incision commencing at the ear, opposite the meatus auditorius, and carried obliquely downward and forward, so that it passed over the base of the lower jaw near the chin, passed under the chin, and terminated upon the outer edge of the anterior belly of the left digastric muscle. From thence downward to the thyroid cartilage, along the lower edge of this, across the sterno-mastoid muscle, and terminating about an inch behind the mastoid process of the temporal bone, upon the os occipitis. Another incision from the termination of this, passed along under the ear to meet the commencement of the first. (See dotted line in plate I.)

The tumor was now dissected from the parts beneath, beginning opposite the thyroid cartilage, so as to detach the lower part first, in order not to have the dissection obscured by the flow of blood. In this way, the operation was carefully continued until the base of the jaw was exposed, then separating the cheek from above downwards, the morbid mass was removed. The jaw-bone was denuded to the extent of about an inch, near the posterior angle, but only slightly carious. In this operation, almost the whole of the digastric muscle, anteriorly and posteriorly, all the sub-maxil-

lary gland, part of the mylo-hyoideus, and stylo-hyoideus muscles, were removed. The venous hemorrhage was very great from the large size of the veins, which returned the blood from the tumor; they were visible upon the surface of the tumor. Only three arteries were divided; the labial, and two smaller branches; one appeared to be a branch of the superior thyroidal, and the other of the occipital. They bled very little.

The operations occupied about one hour and fifteen minutes, and the patient lost perhaps nearly thirty ounces of blood, mostly venous.

6 P. M.—The patient is somewhat exhausted by the loss of blood and the exertion he has been obliged to use during the day: complains of a good deal of pain in the wound, and has some difficulty in swallowing; he is also subject to a cough, which now becomes exceedingly troublesome; pulse feeble, small, and frequent; skin hot and dry. Is directed to take of Tinct. Opii. gtt. lx.

Nov. 15, 9 A. M.—Has rested well during the night, and is comfortable when not disturbed by the cough; has taken very little nourishment, in consequence of the difficulty of swallowing; skin is natural; pulse less frequent, and fuller; tongue does not manifest any febrile disposition.

12½ P. M.—The difficulty of swallowing food and the cough are the only unpleasant symptoms under which the patient labors. Directed an anodyne draught in the evening. Contrary to direct injunction, the patient left his bed and walked across the floor.

Nov. 16, 12 o'clock.—Patient passed a comfortable night, and is considerably better this morning. State of pulse and skin favorable; the former rather feeble; has had an evacuation from his bowels spontaneously; is directed to take as much nourishment as the state of his throat will permit; is allowed a bottle of ale.

Nov. 17, 12 o'clock.—The inflammation which rendered deglutition so difficult, has in a great measure abated; he is now able to take a sufficient quantity of nourishment, in consequence of which his pulse is better, and his whole appearance has improved; he is now allowed, in addition to the ale, a little wine. Suppuration had softened the dressings, and they appeared loose, in consequence of which they were removed and the wound dressed. Its appearance is rather more favorable than was anticipated; but the whole of the disease is by no means removed.

The extent of the wound in length is six inches, and three in width. There is a small black slough just where the tumor was first discovered; below that and the chin, there is a cluster of exuberant granulations, somewhat resembling those situated on the edges of the opening of the tumor.

The wound made for taking up the carotid artery is very florid; there is a slough at the bottom, which is becoming loose; its edges are highly inflamed by the acrimony of the discharge from the wound above, which is constantly running into it.

Nov. 18, 12 o'clock.—The patient is improved, he takes solid food with more facility, and is in every respect more comfortable.

The wound was again dressed; its general appearance is somewhat more favorable; the discharge is very acrid, and excoriates the parts about the lower wound. He is directed to take freely of ale and wine.

Nov. 19, 12 o'clock.—Patient is still improving; the wound was again dressed; directed a lotion of 3 ij. of Fowler's solution of arsenic, in 3 viij. of water, to be applied to the exuberant and spongy granulations.

Nov. 20.—The wound is improved; patient is also comfortable; appetite is good; bowels costive; is directed to take, immediately, Rhei. palmat. ʒj. and Sup. tart. potass. ʒij., and to continue the other prescriptions as before.

Nov. 21, 12 o'clock.—Discharge is more abundant, and has inflamed the lower wound considerably, and excoriated the parts about it; his general appearance is better; cough still troublesome, more particularly at night; bowels free; no febrile symptoms.

Nov. 22, 12 o'clock.—The upper wound is much contracted, the posterior part of it is granulating and cicatrizing rapidly; the lower

(Plate 1.)



This plate will convey a very good idea of the tumor. The shaded part is intended to represent the disease far beyond the ulcerated, or fungous projections. It was wished to avoid all the morbid hardness in the incision, and as the dotted lines will show, this was very nearly accomplished. The cutaneous veins anterior to the ear, are seen much enlarged, and the arteries and veins on other parts of the tumor, and around it were in a very distended state.

is still very much inflamed, and rendered extremely sensitive by the discharge of the other; directed to cover the upper wound with flour and lint, and to take the Spermaceti mixture whenever the cough is urgent.

Patient is improving, and would be very comfortable if not disturbed by the cough, which prevents him from resting well.

Nov. 23, 9 A. M.—Patient has not rested well, cough exceedingly troublesome; pulse still feeble; dressings were again removed; the wound above looks well; the lower is very much irritated by the discharge, its edges are highly inflamed, and bleed upon a slight touch; his appetite is good, and he takes sufficient quantity of nourishment, with wine and porter; is directed to take in addition to the other remedies, Tinet. Cinch. $\frac{3}{4}$ ss. every two hours; the upper wound is granulating rapidly; all the old sloughs are removed; the ligatures have all come away; the suppuration has the appearance of healthy pus, but is extremely acrid; has no odor.

Nov. 24.—Patient is in a fair way to do well. The cough remains by far the most troublesome symptom he has; it frequently prevents him from sleeping, and irritates the wounds by the motion it occasions; his general appearance is however improving, his appetite is good, and he is subject to no pain. The wound is dressed daily; its appearance is highly flattering; the whole surface now is florid, since the sloughs are removed; the granulations are, however, spongy on the anterior part, but at the other parts they are perfectly healthy; the lower wound is less highly inflamed, and the discharge is considerable, but less acrid.

Nov. 27.—The patient is perhaps a little better than at the last report; cough is still frequent, and renders him restless at night; it is now attended with a copious expectoration; deglutition is less difficult, and his appetite is reasonably good; he has been constantly free from fever, though his pulse is still frequent.

The wounds are dressed daily; the lower edge of the upper wound is contracting rapidly; along the upper edge there is a range of exuberant and morbid granulations, projecting a quarter of an inch above the skin, partaking somewhat of the character of the original fungus.

The ligatures on the carotid came away to-day, adhering to the portion of artery included between them, and separating nearly half an inch of artery from the points at which they were applied.

Nov. 30.—Patient continues to do well; his health generally is much better than before the operation; he is not as strong, but is in every respect more comfortable; the cough is an accidental thing, and in no way necessarily connected with the consequences of the operation; it gives him more uneasiness at present, than the wounds themselves.

He prefers a sitting posture in bed, and is supported in that posture by a bed-chair. All his symptoms continue favorable, but his improvement is very gradual.

The wounds have not altered much in their appearance; the

acid discharge from the upper, operates very much against the amendment of the lower, and the granulations have somewhat the character of the original tumor, bleeding upon the slightest touch, and are exquisitely sensitive.

Dec. 7.—Patient has not been as well as usual; cough prevents him from sleeping, and the motion produced by it irritates the wounds; expectoration is very considerable; he seems to be depressed and anxious. The discharge from the wound is less acrid, and has allowed the lower wound to get into a much better state; it is now completely filled up; the granulations are, however, flabby, and do not appear inclined to cicatrize. The surrounding parts are not so florid and sensitive as they have been.

His neck is drawn considerably to one side, and he is unable to move it; he thinks it partly owing to its resting constantly in one position on the bed-chair. Is directed to lay in a recumbent posture, and occasionally to leave his bed and sit in an easy chair; appetite not so good as usual.

Dec. 15.—The patient has recovered a little from his late indisposition; the stiffness of the neck still remains; appetite good; an anodyne procures him rest at night; the upper wound not improved much; the morbid granulations are at least half an inch above the skin, and in some places a little higher; he leaves his bed daily, and passes several hours in an easy chair.

From this time, his health appeared to be gradually on the decline. The lower wound in a little while healed up; the upper underwent but little alteration from this time forward. The cough continued to be very troublesome, the expectoration very copious, and evidently purulent. He became regularly hectic, accompanied with great emaciation, and died on the 3d of March, 1819, having lived three months and nineteen days after the operation.

It will be perceived, from the account of this case, that the cough was aggravated by the operation, but not produced by it. In three instances in which we have seen the carotid tied, a very considerable cough has attended, until suppuration was fully established in the wound, when it has subsided. My patient labored under a cough before the operation, and there was a manifest increase of it for a week or more after its performance, but it by no means was the cause of its continuance, as the dissection after death will evince. The hectic symptoms arose from the diseased condition of the mucous membrane of the trachea and its bronchial ramifications, rather than the irritation of the ulcer left from the operation. His death may therefore, with more propriety, be attributed to the pulmonary, than the fungous disease.

DISSECTION.

The carcinomatous granulations had risen a little above the surrounding surface; the size of the ulcer had considerably contracted since the operation; the lower jaw was exposed to some extent about the posterior angle, but very little carious.

On opening the thorax, the lungs appeared externally to be in a healthy state, with the exception of several adhesions of one lung to the pleura costalis. Upon dividing the trachea a little above the bronchiæ, it was found nearly filled with pus; the lungs, when cut into, exhibited the same appearance at innumerable points, without the least vestige of ulceration at any part. The mucous membrane was rough, and thickened in the trachea, and also in the bronchial ramifications.

The abdominal viscera were sound, except the kidneys. In the tubular part of each was found a small abscess about the size of a nutmeg, apparently containing a healthy looking pus.

As this afforded me an excellent opportunity of examining the arteries on the right side of the head and neck, after the carotid had been tied; and not knowing that any such case had been recorded, I gladly availed myself of it, and separated the head, neck, and shoulders, in the following manner:—

Having sawed through the sternum at the upper part, so as to leave the clavicles attached, the superior extremities were removed from the trunk, and the dorsal vertebræ and ribs divided between the second and third, so as to leave it of a bust-like shape. This preserved the shoulders in such a way that the subclavians and their branches might be injected. The ascending arch, and a portion of the descending aorta were also included in the preparation.

To secure the filling of the arteries of the head and neck, a long pipe was passed up the aorta into the left carotid, and a fine wax injection was thrown in with great care, and, as the subsequent account will show, with great success. The aorta was next injected to fill the subclavians and their branches. In the dissection, which was conducted with the greatest care and attention, I was assisted by David L. Rodgers and Alexander F. Vaché, two of my pupils, ardent in the pursuit of anatomical and surgical knowledge.

The following description of the arteries of the head and neck is taken from the preparation, and they are delineated as far as possible in the annexed engravings.

1st. *The arteries that supplied the right side of the head and neck, after the carotid had been tied.* See plate II.

To give a regular description of these arteries, would be incompatible with the principle of collateral circulation—inasmuch as they are found to vary in different subjects, for “the inosculation is never carried on by any particular set of vessels, but by all the arteries of the neighboring parts.”

Upon removing the integuments on the fore-part of the neck, and laying bare the carotid artery from the innominata to the angle of the jaw, its calibre was found completely obliterated from its origin to its bifurcation; leaving a firm, ligamentous cord, which was divided into two parts, showing the place where the ligatures had been applied.

The vein and nerve were perfectly natural. The right subcla-

vian was much enlarged, being equal in size to the innominata, from its origin to the scaleni muscles.

The left carotid was enlarged to twice its natural diameter; its branches increased in the same ratio, and assumed a tortuous and irregular course.

When we take into consideration the connexion which the arteries of the left have with those of the right side of the head, and their free inosculation with the subclavian, we can have in our imagination the branches that must necessarily supply the place of the right carotid. First, we have the branches arising from the subclavian, which are very numerous; secondly, those arising from the left carotid, which are still more numerous.

A minute detail of the numerous vessels which communicate with the carotid, would be tedious and uninteresting, and would perhaps be impracticable, were it deemed expedient. Suffice it to notice the principal branches, and to give a general description of the smaller, but not less beautiful inosculations. We find, then, arising from the right subclavian, first, the *arteria thyroidea inferior*; secondly, the *cervicalis profunda*; thirdly, the *cervicalis superficialis*; and, fourthly, the vertebral arteries.

The inferior thyroid, as it arises from the subclavian, divides into four branches—two passing downwards and outwards, and the other two passing upwards; the latter are called the *ramus thyroideus*, and the *thyroidea ascendens*. These require particular attention from their large size, and the important supply of blood which they furnish for the support of the arteries of the neck. While the superior arteries were enlarged to twice their natural diameter, the two inferior ones, viz., the *transversalis colli*, and the *transversalis humeri*, although arising from the same trunk, and receiving their currents of blood in the most favorable direction, still retained their natural dimensions. But this phenomenon usually occurs in the circulating system. John Bell observes, “that in whatever way the demand of blood upon an artery or set of arteries is increased, the effect is an accelerated motion of blood towards that artery.” And again, “any demand of blood causes an enlargement of the arteries leading to the part which demands the blood.”

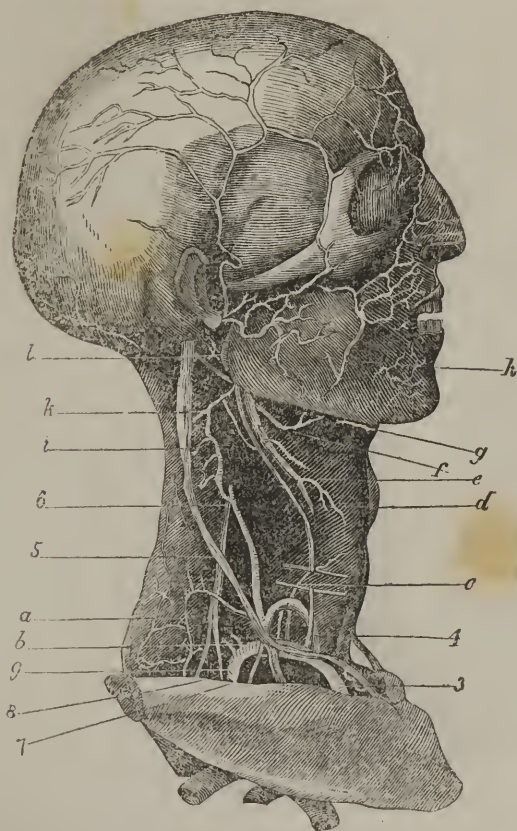
Guided then by this principle, we need not be surprised that the subclavian is so much enlarged from its origin to the scaleni muscles; for here it affords a supply of blood to new and important parts. The *ramus thyroideus* passing upwards to the thyroid gland, and anastomosing with the superior thyroidal artery, was one great source of blood; its branches were large and tortuous, forming communications in every direction, with those from above.

The *thyroidea ascendens* is naturally a small and unimportant branch; it was here three times its usual size, mounting up the neck in a zig-zag direction, lying close to the vertebræ, forming frequent communications with the vertebral artery, dividing into many small branches at the upper part of the mastoid muscles, forming a beautiful plexus of vessels, with the mastoid branch of the occipital

artery, and sending branches to all the muscles on the upper part of the neck.

The *cervicalis profunda* and *superficialis* were much enlarged, sending frequent branches upwards to anastomose with the descending branches of the occipital artery. By far the most important and interesting part of the circulation yet remains to be described.

(Plate 2.)



In this plate is represented the right carotid artery, obliterated from the innominate to the bifurcation. The success with which the circulation was carried on to the head through the inosculating channels, may also be seen in the enlarged anastomosing branches.

Fig 1. Right bronchial tube.

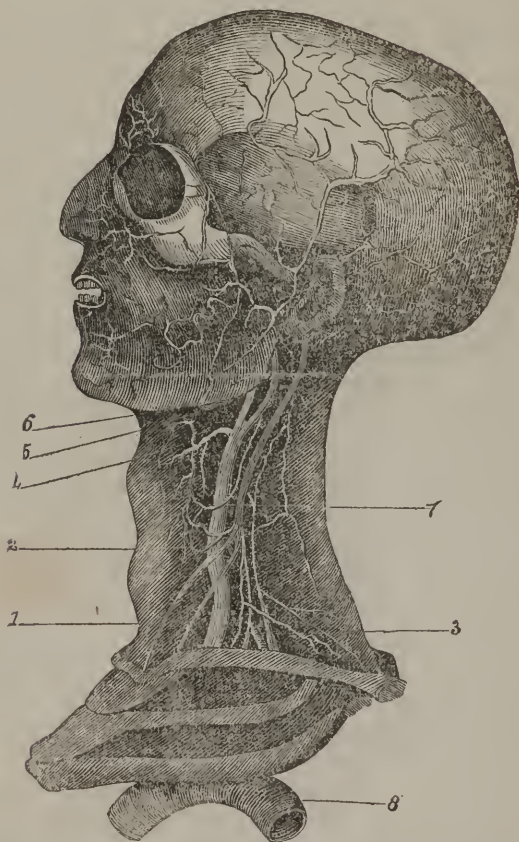
Fig. 6. Thyroidea ascendens.

2. Aorta.
3. Arteria Innominate.
4. Ramus thyroideus arteriæ thyroideæ.
5. Sterno-cleido mastoideus.
- a Transversalis colli.
- c Portion of the carotid separated by the ligatures.
- e Superior thyroidal artery.
- g Mental artery.
- i Plexus of arteries formed by inosculations of the ascending thyroid, and a descending branch of the occipital.
- l External carotid filled with injection.
6. Thyroidea ascendens.
7. Scalenus anticus musculus.
8. Subclavian artery, after it has passed the scaleni muscules.
9. Transversalis humeri of its natural size.
- b Cervicalis superficialis et profunda.
- d Obliterated carotid.
- f Inferior portion of the labial, as divided in the operation.
- h Superior portion of the labial, where tied in the operation.
- k Descending branch of the occipital.

2dly. *The arteries of the left side of the head and neck.* See plate III.

The left carotid passing up the neck equal in size to the innominate, furnished the greatest part of the blood for the right side.

(Plate 3.)



This plate will give some idea of the success which attended the injection of the left side of the head and neck. Most of the more considerable vessels are here delineated, but the beauty of the preparation far surpasses the plate, in the minuteness with which the vessels are filled. All of these are preternaturally enlarged. Only a few of the arteries which are most enlarged, will be referred to in the explanation of this plate. There is no variety in the course or distribution of the arteries.

- Fig. 1. The two portions of the sterno-cleido mastoideus muscle.
 2. Left carotid artery, as large as the innominate.
 3. Left subclavian artery, external to the scaleni muscles.
 4. Superior thyroid artery.
 5. Labial artery much enlarged.
 6. Mental artery twice its common size.
 7. Par vagum raised up, and seen crossing the carotid artery.
 8. Arch of the aorta.

This beautiful preparation is still in fine preservation in my museum at the Medical College of the University.

In order to determine what particular arteries were enlarged, it is necessary only to enumerate the branches given off from the carotid, and more particularly those which arise from its forepart. Below the jaw there are four: to wit, the superior thyroid, the lingual, pharyngeal, and the maxillaris interna, which inosculate with open mouths, having the appearance of continuous trunks, and sending a plentiful supply of blood to the neck and internal parts of the face.

The labial and temporal arteries leaving the axilla under the angle of the jaw, and passing upwards upon the face, send off small branches in a beautiful and fantastic manner. Branches which before were considered unworthy the attention of the anatomist, now rise into importance. The plexuses and inosculationes formed by these branches, excite alike our surprise and admiration, and elucidate, in the most beautiful manner, the principles of collateral circulation. These arteries, in general, are large and tortuous, and have frequent communications among themselves. The arteries most enlarged were the mental, the inferior labial, the coronary, and the angularis. The optic artery was likewise much enlarged, beautifully anastomosing with the angularis.

So freely did these arteries inosculate with those of the right side, that before the operation was finished, it was found necessary to secure the labial artery in a ligature. This was clearly illustrated by the retrograde course of the injection, after death, which passed freely from the arteries of the opposite side, filling the superior portion of the labial, to the point at which the ligature had been applied. The temporal artery was of its natural size, receiving its blood from "all the arteries of the neighboring parts," from the ascending branches of the occipital, the left temporal, the ophthalmic, and the transverse facial. This free communication was distinctly shown by the injection, which, passing down the temporal, completely filled the external and internal carotids, and several of their branches; particularly the inferior portion of the labial, which is seen emerging from under the jaw, to pass upon the face. The labial terminated at that point where the mental is given off. The mental itself passed on to its usual destination, and received blood from its fellow of the opposite side.

All of these arteries will be easily seen, and readily recognised, by referring to the plates.

No. III.—MARCH 15, 1827.—FIRST SUCCESSFUL CASE OF LIGATURE UPON THE PRIMITIVE ILIAC ARTERY, FOR ANEURISM. By Valentine Mott, M. D., Professor of Surgery, N. Y. (See the American Journal of the Medical Sciences, Philadelphia, 1827, vol. I., p. 156-161.)

A detailed account of the first operation ever performed upon the *arteria iliaca communis*, for the cure of *aneurism*, and especially of the first attempt to apply the ligature to so great a vessel, with-

out dividing the peritoneum, may prove interesting to the profession generally, and must be immediately serviceable to practitioners of surgery. It is therefore as an act of duty, rather than of choice, that the following statement has been prepared, during such few and brief intervals of leisure, as could be obtained amid the daily engagements and solitudes of business.

On the 15th of March, 1827, I was requested to visit a patient with Dr. OSBORN, (of Westfield, New Jersey, about twenty-five miles distant from New York,) whom we found laboring under a large aneurism of the right external iliac artery.

Israel Crane, aged thirty-three years, by occupation a farmer, of temperate and regular habits, having generally enjoyed excellent health, says about the middle of January he felt some pain about the lower part of the belly, which he attributed to a fall received during the winter. He is in the habit of using great efforts in lifting heavy logs of wood, as his employment at this season consists in carrying wood to market. It, however, was not until a fortnight since, that he perceived any tumor about the lower part of the abdomen. Upon examination, the abdomen on the right side was considerably enlarged from about the crural arch, as high as the umbilicus. When the hand was applied to the parietes of the abdomen, a pulsation was felt and rendered visible to some distance. To the touch the tumor beat violently, and appeared to contain only fluid blood. It commenced a little above Poupart's ligament, and reached, judging by the touch, from without, near the navel—inwards, almost to the linea alba—outwards and backwards filling up all the concavity of the ilium, and reaching beyond the posterior spinous process of that bone.

The rapid increase of this aneurismal tumor occasioned, as the countenance of our patient indicated, the most extreme agony. His sufferings at times were so great that his screams could be heard at a distance from the house. He had been bled several times, taken light food, and was kept constantly under the effect of opium. He was now informed of the serious nature of his case, and that without an operation very little chance of his life remained; with great composure, he immediately consented to whatever would give him the best prospect of saving his life.

From the extent and situation of the tumor, he was apprised of the uncertain nature of the operation, as well as the difficulty of performing it, and indeed that it would require an artery to be tied, which never had been before operated upon for aneurism. With these views of his situation, he cheerfully submitted to be placed upon a table of suitable height, in a room which was well lighted.

Then, in the presence of Dr. Osborn, Dr. Liddle, and Dr. Cross, the following operation was performed:—

The pubes and groin of the right side being shaved, an incision was commenced just above the external abdominal ring, and carried in a semicircular direction half an inch above Poupart's ligament, until it terminated a little beyond the anterior spinous process of the ilium, making it in extent about five inches. The in-

teguments and superficial fascia were now divided, which exposed the tendinous part of the external oblique muscle, upon cutting which, in the whole course of the incision, the muscular fibres of the internal oblique were exposed; the fibres of which were cautiously raised with the forceps, and cut from the upper edge of Poupart's ligament. This exposed the spermatic cord, the cellular covering of which was now raised with the forceps, and divided to an extent sufficient to admit the fore-finger of the left hand to pass upon the cord into the internal abdominal ring. The finger serving now as a director, enabled me to divide the internal oblique and transversalis muscles to the extent of the external incision, while it protected the peritoneum. In the division of the last mentioned muscles outwardly, the circumflexa ilii artery was cut through, and it yielded for a few minutes a smart bleeding. This, with a smaller artery upon the surface of the internal oblique muscle, between the rings, and one in the integuments were all that required ligatures.

With the tumor beating furiously underneath, I now attempted to raise the peritoneum from it, which we found difficult and dangerous, as it was adherent to it in every direction. By degrees we separated it with great caution from the aneurismal tumor, which had now bulged up very much into the incision. But we soon found that the external incision did not enable us to arrive to more than half the extent of the tumor upwards. It was therefore extended upwards and backwards about half an inch within the ilium, to the distance of three inches, making a wound in all about eight inches in length.

The separation of the peritoneum was now continued, until the fingers arrived at the upper part of the tumor, which was found to terminate at the going off of the internal iliac artery. The common iliac was next examined, by passing the fingers upon the promontory of the sacrum; and to the touch appearing to be sound, we determined to place our ligature upon it about half way between the aneurism and the aorta, with a view to allow length of vessel enough on each side of it to be united by the adhesive process.

The great current of blood through the aorta made it necessary to allow as much of the primitive iliac to remain between it and the ligature as possible, and the probable disease of the artery higher than the aneurism, required that it should not be too low down. The depth of this wound, the size of the aneurism, and the pressure of the intestines downwards by the efforts to bear pain, made it almost impossible to see the vessel we wished to tie. By the aid of curved spatulas, such as I used in my operation upon the *innominata*, together with a thin, smooth piece of board, about three inches wide, prepared at the time, we succeeded in keeping up the peritoneal mass, and getting a distinct view of the arteria iliaca communis, on the side of the sacro-vertebral promontory. This required great effort on our part, and could only be continued for a few seconds. The difficulty was greatly augmented by the eleva-

tion of the aneurismal tumor, and the interception it gave to the admission of ligament.

When we elevated the pelvis, the tumor obstructed our sight; when we depressed it, the crowding down of the intestines presented another difficulty. In this part of the operation I was greatly assisted by Dr. Osborn and my enterprising pupil, Adrian A. Kissam.

Introducing my right hand now behind the peritoneum, the artery was denuded with the nail of the fore-finger, and the needle conveying the ligature was introduced from within outwards, guided by the fore-finger of the left hand in order to avoid injuring the vein. The ligature was very readily passed underneath the artery, but considerable difficulty was experienced in hooking the eye of the needle, from the great depth of the wound and the impossibility of seeing it. The distance of the artery from the wound was the whole length of my aneurismal needle.

After drawing the ligature under the artery, we succeeded, by the aid of our spatulas and board, in getting a fair view of it, and were satisfied that it was fairly under the primitive iliac, a little below the bifurcation of the aorta. It was now tied—the knots were readily conveyed up to the artery by the fore-fingers—all pulsation in the tumor instantly ceased. The ligature upon the artery was very little below a point opposite the umbilicus.

The wound was now dressed with five interrupted sutures, passing them not only through the integuments, but the fibres of the cut muscles, so as to bring their divided edges together at all parts of the incision, which was muscular. Adhesive plaster to assist the stitches, and lint and straps to retain it, completed the dressing. The operation lasted rather less than one hour.*

He was removed from the table and put into bed upon his back, with the knee a little elevated upon pillows, to relax the limb as much as possible, and to avoid pressure upon it. It was considerably cooler than the opposite leg, and flannels were applied all over it, and a bottle of warm water to the foot. From the habit he had been in of taking largely of anodynes, a tea-spoonful of the tinct. opii. was administered, with directions to repeat it in an hour if the pain should be severe.

In less than one hour from the operation, considerable reaction of the heart and arteries took place; he felt, as he stated, altogether relieved from the excruciating agony he had suffered since the aneurism commenced. The whole limb had now recovered its natural temperature.

* Dr Gibson, then professor of surgery in Baltimore, was near the spot during the riots in that city, when a man was wounded by a musket ball, "which entered the left side of the abdomen, passed through the intestines, opened the iliaea communis artery, and lodged in the sacrum" The doctor states, "thrusting into it (the wound) the fore-finger of my left hand, I discovered that a very large artery had been torn across, and was pouring out blood in considerable quantity." The man died in a few days. "Upon inspecting the vessels of the abdomen," says the doctor, "I found that I had placed two ligatures upon the common iliac artery of the left side, one about half an inch below the bifurcation of the aorta, and the other immediately above the division of the artery, into the external and internal iliaes." See Medical Recorder, Vol. III., p. 185.

March 16th.—The day after the operation, pulse eighty—skin moist—limb warm as the other—complains of some pain at the ligature—ordered a purgative of neutral salts.

17th.—Pulse eighty, and fuller than yesterday—took 3 x. of blood from his arm—skin moist—tongue brown—considerable uneasiness in the limb—no pain at the ligature—leg of natural heat—salts had a good effect.

18th.—Pulse seventy-five—skin moist—tongue white—pain in the limb considerable—no pain at the ligature or in the wound—limb warm.

19th.—Bled him to-day to ten ounces, the pulse being tense and beating eighty strokes in a minute—repeated the cathartic—suppuration appearing to have taken place, the dressings were removed.

20th.—Pulse seventy and soft—skin moist—wound looks well—pain in the limb continues—leg warm as the other—cathartic operated well.

21st.—Pulse seventy and soft—wound looks well—repeated the laxative—pain in the leg rather less—continues warm. There has been at no time tension of the abdomen, or any particular uneasiness in that part. The patient thus far has been altogether more comfortable than could have been imagined. He takes more or less opium daily, from the long habit he has been in of taking anodynes.

26th.—No unpleasant symptoms—wound looks well—bled again to 3 xij, as there was a little tumefaction and inflammation about the wound.

30th.—Our patient continues to do well—wound dressed daily.

April 3d.—Not being able to leave the city, I requested Dr. Proudfoot, my late pupil, and a most promising young surgeon, to visit the patient. He reports that he was free of fever—wound all healed but where the large ligature was passing. The ligature appearing to be detached, the Dr. took hold of it and removed it: this was on the eighteenth day from the time of its application. Limb of the natural temperature—enjoined upon him to keep very quiet and in bed.

8th.—There are no disagreeable appearances whatever—he appears to be doing remarkably well—has been bled once since the last report—takes a purgative every other day, and an opiate every night—pulse as in health—no pain—says he is entirely comfortable—wound is dressed with dry lint.

16th.—Has improved rapidly since the last report. Two days after the ligature came away, he very imprudently got out of bed, without experiencing any difficulty except weakness. Rode out to-day—wound perfectly healed.

April 26th.—He has been using crutches for a few days to favor the lame leg, which, as yet, feels rather weak. General health greatly improved.

30th.—Is perfectly restored in health—has a little stoop in his walk, which he says is occasioned by the external cicatrix. Leg is not yet of its full size, nor quite so strong as the other. From the period of the operation to the recovery of our patient, he did not

appear to suffer more pain, or have more unpleasant symptoms, than would ordinarily take place in a flesh wound of equal extent. Much of this, in my opinion, is to be attributed to the prompt and judicious antiphlogistic treatment pursued by Dr. Osborn, to whom I am indebted for the daily reports of the case.

May 29th.—My patient visited me to-day, having come twenty-five miles; he was so much improved in health that I did not recognize him. Examined the cicatrix, and found it perfectly sound—could not discover any remains of aneurismal tumor—felt the epigastric artery much enlarged and beating strongly, and feeble, though distinct pulsation in the femoral artery immediately below the crural arch. The leg has its natural temperature and feeling, and he says it is as strong as the other.

Much credit is due the patient for his firmness on the occasion; although apprised of the great danger attending so formidable an experiment, and the uncertainty of its result, yet, with a fortitude unshaken, and a full conviction that it was the only chance of prolonging his life, he cheerfully and resolutely submitted to the operation.

The gratification his visit afforded me is not to be imagined, save by those who have been placed under similar circumstances. The perfect success of so important and novel an operation, with the entire restoration of the patient's health, was a rich reward for the anxiety I experienced in the case, and in a measure compensated for the unexpected failure of my operation on the *arteria innominata*.

This patient very recently paid me a visit, and is up to the present moment, (December, 1845,) in the enjoyment of excellent health, and pursuing his occupation of carpenter.

NO. IV.—SEPTEMBER 26TH, 1829. THE BRASDOREAL, DISTAL, OR ANTI-CARDIAL OPERATION FOR ANEURISM OF THE ARTERIA INNOMINATA, INVOLVING THE SUBCLAVIAN AND THE ROOT OF THE CAROTID, SUCCESSFULLY PERFORMED BY TYING THE CAROTID ARTERY. By Valentine Mott, M.D., &c. (See the *American Journal of the Medical Sciences*, Philadelphia, 1829, Vol. V., p. 297–300.)

Notwithstanding the tone of decided reprobation and ridicule with which ALLAN BURNS* expresses himself concerning BRASDOR's proposition to apply the ligature upon the anticardial side of certain aneurismal tumors, and the numerous arguments urged against the revival of his operation by some professional critics of considerable authority, experience seems to have shown that it is not only safe, but in some cases superior to the Hunterian mode of treatment. Some of the cases in which the operation on the anticardial side of the tumor has been lately performed in Europe, are said to

* Surgical Anatomy of the Head and Neck.

have proved successful ;* and I am gratified to have it in my power to add another instance of its success in perhaps the first case, in which this operation has been performed in America.

Moses R. Gardner, ætat. 51, by profession a farmer, of sound constitution and good habits of life, applied to me some time in March for advice.

He gave the following relation of his case :—About three years ago, while occupied in removing a building, and compelled to lift heavy weights, he was attacked with pain in the upper and back part of the neck. This lasted until the month of January, when it extended to the right shoulder and arm, and continued until the following May ; it then partially subsided, and he observed his voice was becoming hoarse, which he attributed to exposure and consequent cold. About eighteen months since, while shaving, he discovered a small swelling at the upper part of the breast bone, but did not remark any throbbing in it until some time afterwards. He had consulted a physician, but received no positive opinion on the case.

Upon examination, I found above the sternum a pulsating tumor, about the size of a pigeon's egg, spreading some distance under the clavicular and sternal portions of the right sterno-mastoid muscle, in the course of the subclavian artery, and extending as low down upon the pleura as the second rib, compressing more or less the bronchial tubes, and producing on the least coughing or exercise a wheezing, not unlike that of asthma. He shrunk from the least pressure upon it ; complaining of impeded respiration, followed by pain. Its pulsations were synchronous with those of the heart, and decidedly aneurismal.

After fully explaining to him the nature of his disease, and its probable fatal termination, should it increase and be left to itself, I advised him to return home ; to avoid all exertion ; to be occasionally bled, and to confine himself principally to a vegetable diet ; but should he observe the least increase, either of the tumor or any of his symptoms, to come again to me, and I would decide on the propriety of an operation.

After that time, I occasionally saw him ; he seemed to understand his case fully, and was very desirous to take the chance of the operation ; but as I could not observe any material change in the disease, I recommended him to pursue the same directions, and wait patiently until it should occur.

On the 12th of September he again came to the city. I found the tumor above the sternum had increased to the size of a large walnut, and upon a careful application of the stethoscope, it was evidently encroaching more upon the chest. The whizzing sound, (*bruit de soufflet*,) could be heard ; the thoracic viscera were sound, the respiratory murmur being distinct throughout. His respiration was very much impeded by speaking, walking, or coughing, and almost entirely suspended by the least pressure upon the tumor ; the action of the right carotid was much more feeble than that of the left ; no pulsation could be discovered in its branches ; the

* See Wardrop on Aneurism. London, 8vo. 1828.

right subclavian, external to the scaleni muscles, was natural, while the axillary and brachial arteries could hardly be felt; at the wrist no pulse could be found; the pulsations of the arteries of the left side were natural. His general health was good.

In reflecting upon this case, and comparing the relative situation of the parts, I was persuaded the aneurism was of the arteria innominata, involving the subclavian and the root of the carotid; having formed this conclusion, I considered it a proper case for the operation proposed by Brasdor, and recently so ably revived, and first successfully performed by the distinguished WARDROP, whose scientific researches and masterly views of this subject, have since been so fully confirmed by himself and others.

I thought further delay unnecessary, and the patient being willing to abide by my judgment, after having stated to him the chances of the operation, I resolved on its performance. From the evident interruption in the circulation of the right arm, and the apparent effort of nature to effect a spontaneous cure, I determined upon tying the carotid first, to observe the result, and afterwards to secure the subclavian, should it be required.

On the 26th of September I operated. The artery was taken up in the usual manner; no material change was observed.

27th.—9 A. M. Slept well, and feels refreshed; thinks there is more room, as he expresses it, in breathing; complains of a little soreness of the tonsils in swallowing; pulse 58, regular and tranquil; skin natural, pulsation and size of the tumor evidently diminished. 9 P. M. Much more restless from mental alarm; pulse 68, tense. In other respects, the same as in the morning; being habituated to laudanum, was permitted to take a tea-spoonful.

28th.—9 A. M. Slept well after the opiate; breathes easily, and says he takes "a more satisfactory breath," than he did before the operation; feels much less of the pulsation in the tumor; pulse 63, not so tense; skin natural; cough much less. Ordered a dose of calcined magnesia and Epsom salts. 9 P. M. Has passed a comfortable day; his wife, who arrived from the country since the morning, expressed her surprise at the improvement of his voice and breathing; and the difference in the beating of the tumor. Pulse of the right radial artery very distinct, but intermitting once in every ten to fifteen beats; in the left arm 80; coughs frequently, and expectorates freely; skin natural; tongue a little white; salts have not operated. Ordered the dose to be repeated, and if restless, after its operation, to take his usual anodyne.

29th.—Saluted me this morning upon entering his room, with a full and fine voice, and said he was well enough to call on me; salts operated freely; thinks his cough and expectoration much less. I found him lying down, and breathing quietly; pulse 71, and regular. The radial artery of the right arm beating as last evening, with fewer intermissions, but of longer continuance; skin over the tumor more wrinkled; pulsation appears less, and feels weaker. Directed to continue his tea, toast, and gruel. 8 o'clock. As well as in the morning; takes a full breath without the least wheezing;

pulsation in the right wrist very distinct and regular; in the left 62 to the minute. Continues the opiate.

30th.—Found him lying more recumbent than at any former period; pulse 70, and regular; right radial artery does not beat quite so firm as yesterday; the wound discharging a little, was dressed.

October 2d.—Says he now feels as if he would get well; cough rather more troublesome; pulse 57; pulsation of the right radial the same; his bowels not being free, directed sub. mur. hydr. grs. viij.—sup. tart. potassæ, pulv. jalapæ, aa ʒj. Mix. Evening. Medicine has not operated; directed a dose of sulphate of magnesia.

3d.—Cough and bronchial effusion very much diminished by the operation of the cathartic; pulse 68.

4th.—Feels very well; passed a good night; all his symptoms improved; pulse 74; can bear any degree of pressure upon the tumor without the least pain or difficulty of breathing.

10th.—Continues to mend, and is sanguine as to his recovery; pulsation of the tumor hardly perceptible, and to the touch very much diminished; cough less troublesome; left pulse 66; right, very feeble.

16th.—Ligature separated and came away last night; the tumor above the sternum, and pulsation entirely disappeared; cough and breathing better; voice nearly natural; pulse 66; now and then a very faint pulsation of the right radial artery; right hand a little swelled, and feels numb, and the patient complains of the want of power to close it.

22d.—Wound just healed; weakness of the arm very considerable; fingers very thick and clumsy; arm swelled and pits upon pressure; no pulse in the right radial artery; breathing very easy; cough and expectoration much less; can sleep easy in any position, which he has not been able to do for many months.

26th.—Left town this morning for his residence in New Jersey.

SECOND REPORT OF PROFESSOR MOTT'S CASE OF ANEURISM, TREATED BY TYING THE ARTERY ULTRA TUMOREM. (*Ib., Amer. Jour. of the Med. Sciences*, Phil., 1830, Vol. VI., p. 532.)

After the return of Moses Gardner to the country, he occasionally wrote to me: one of his letters stated, "his breathing was much better, and his friends on calling to see him, were surprised at the improvement, particularly at the disappearance of the tumor." On the 22d of April, however, I received information of his death, with an invitation to examine the body: all that could be ascertained relating to the case, was, that the difficulty of breathing had returned and at times threatened immediate suffocation; he had confined himself to the most abstemious living, and gradually declined in general health. The dissection was conducted by my demonstrator, Dr. Vaché, to whom I am indebted for the following particulars:—

"Dissection.—On viewing the body, no tumor appeared externally: the right clavicle was rather more elevated than that of the

opposite side, and on removing the integuments, it was found partially dislocated from its sternal articulation, the under surface of which has undergone considerable absorption from the pressure of the aneurism. Immediately beneath, and imbedded in the surrounding parts, was the tumor; it extended from the sternal extremity of the left clavicle, along the inner and upper surface of the sternum, to which it closely adhered, to about midway of the right clavicle, and pressed as low down upon the pleura as the third rib. Laterally it was adherent to the right lung, and posteriorly rested upon the lower cervical and upper dorsal vertebræ.

The trachea was greatly displaced; it was closely attached to the left side of the tumor, passing obliquely downward and backward, and very much flattened by pressure.

On removing the tumor from the body with its connexions, it was about the size of the two fists, and its parietes were found to be firmly consolidated. It emanated from the arteria innominata, involving the subclavian and the root of the carotid. Superiorly it was of a globular form, and inferiorly terminated in an apex, which passed down below the division of the trachea, and behind the aorta. The right carotid was obliterated, the right subclavian, beyond the tumor, was pervious and natural in its structure. The heart and lungs were sound."

On reviewing briefly the circumstances of this case, no one, I may venture to observe, will attribute its fatal termination to a failure of this form of operation, or of the principles upon which it is founded. The attending symptoms, as well as the dissection, fully prove the cause of death to have been the displacement of the trachea, and the consequent pressure of the consolidating tumor upon it and the bronchial tubes. The absence of pulse in the right arm, the œdema and the numbness must also be attributed to the pressure of the tumor. Had the operation been performed at an earlier stage of the disease, there is every reason to expect it would have terminated successfully. Should I have another opportunity, I will operate without any delay, and tie both vessels at the same time, and not leave one for a future performance, to be decided upon by the effect of the first.

It is perhaps a little singular, that a tumor of this magnitude, should not have appeared much larger externally, for it will be recollected that it never exceeded the size of a walnut. I am happy to add, that the diagnosis for aneurisms of the vessels of the neck and shoulder as given by Mr. Wardrop, in his very able work on this subject, has been fully confirmed in regard to this case.

Dr. Vaché, in a recent note to Dr. Mott, (dated New York, Nov. 27, 1845,) says in relation to this case:—"To reply to your note of yesterday, I found it necessary to refer to the case of Moses R. Gardner, as published in the *American Journal of Medical Sciences*, Nos. 10 and 12, Vols. V. and VI., where it is so truly described as to leave nothing to add, from subsequent reflection, to its history. No person familiar with the surgical anatomy of the neck and shoulder, can read the details of the case, and doubt that he died

from impeded respiration, consequent on pressure and displacement of the trachea, as well as the lung and contiguous nerves and blood vessels. From the dissection I made at the time, I was fully convinced that the operation was perfectly successful; and that he did not die directly of aneurism, the large *consolidated* tumor, I suppose still in your museum, will fully establish at the present day."

No. V.—New-York, 1830. LIGATURE OF THE CAROTID FOR ANASTOMOSING ANEURISM IN A CHILD THREE MONTHS OLD. The *American Journal of the Medical Sciences*, Philadelphia, 1830, Vol. VII., p. 271, says :—

In our fifth volume, page 255, we announced Dr. Mott's having performed this operation. The following extract from a letter recently received from our friend, Dr. A. F. Vaché of New York, gives further particulars of this interesting case :—"You wish to be informed of the termination of the case of the infant whose carotid artery was tied for an aneurism by anastomosis, involving both orbits, the nose, and part of the forehead, and in whom it was intended to tie the other should the first not prove curative. After the operation the tumor evidently diminished, and induced the belief that in time it would be removed altogether without taking off the circulation from the opposite side. Since then the little patient was lost sight of until yesterday, (September 10th,) when Dr. Mott heard of the residence of the parents and visited it. He informs me that he found the tumor diminished about one-third, and so much consolidated as to lead to the opinion of the possibility of extirpating it, should it hereafter be thought necessary. In every other respect the child was in perfect health.*

No. VI.—Sept. 1830. AMPUTATION OF THE THIGH, FOLLOWED BY SECONDARY HEMORRHAGE. THE FEMORAL ARTERY TIED IN SEVERAL PLACES. By Valentine Mott, M. D., &c. (See this case in an account of the surgical cases of the New York Hospital for July, August, September and October, 1830, drawn up by Alfred C. Post, M. D., in the *New York Medical Journal*, New York, 1830. No. 2, Vol. I., p. 271—273.)

John Shannon, aged about thirty years, came into the hospital on account of a disease in the knee joint, of several years standing. He had been addicted to intemperate habits. On the 25th of September, Dr. Mott amputated the thigh a short distance above the knee, by the double flap operation. Every thing went on favorably after the operation. The patient, however, complained of severe pain in the stump recurring every afternoon, for which he took anodynes. The stump was dressed on the seventh day, and was found to be nearly healed. No untoward circumstance occurred until the morning of the 6th of October, (the 12th day from the

* This tumor eventually disappeared entirely, December 1845. V. M.

operation,) when the patient suddenly coughed, and sneezed violently at the same time, and a gush of arterial blood, to the amount of three or four ounces, took place from the stump. The tourniquet was applied, so as to compress the femoral artery, and the hemorrhage was thus arrested for the time. After an hour or two the tourniquet was removed, and the hemorrhage did not recur till the night of the 7th, when about the same quantity of blood was lost as before, and the hemorrhage was temporarily arrested in the same way. At midnight, Dr. Mott tied the femoral artery three or four inches below Poupart's ligament. He tied the artery in two places, and divided it in the intervening space. On the morning of the eighth, a new hemorrhage took place to the amount of about eight ounces. It was arrested by pressure in the groin. At 11 A. M., a consultation of surgeons was held, when it was determined to tie the femoral artery above the profunda, which Dr. Mott accordingly did. On the morning of the ninth, a hemorrhage again took place from the stump to the amount of above five or six ounces. Pressure on the artery, as high in the groin as it could be felt, appeared to exert no control over the hemorrhage, but it soon ceased spontaneously. Dr. Mott directed, if the hemorrhage should be renewed, that a tourniquet should be applied around the middle of the thigh, with the view of compressing the arterial branches in the posterior part of the limb. Early on the morning of the tenth, a slight hemorrhage occurred, which was not arrested by the tourniquet. Spasms came on in the stump, and the hemorrhage became more profuse, amounting to about eight ounces. The spasms were frequently repeated. The pulse became small and feeble, the skin cold and moist, the countenance had a haggard expression, and there was occasional hiccup. On dressing the stump, the angles of the wound, which had been united, were found to have been pressed asunder by coagula of blood, and had a ragged spongy appearance. The wound was dressed with Peruvian ointment. Brandy toddy was given to the patient in the morning, but his stomach soon revolted against it. A sinapism was applied over the epigastrium, but he could not long bear it. Porter and lime water were given in the evening, and a blister applied over the epigastrium. The pulse gradually became fuller and stronger, the irritability of the stomach ceased, and the coldness of the skin diminished. 11th. Noon. There has been a very slight oozing of blood, but no considerable hemorrhage. The symptoms have all become more favorable. The wound has been dressed this morning with pure balsam of Peru. 22d. No hemorrhage has since occurred. The ligatures, which were passed around the femoral artery on the night of the 7th, both came away this morning with the dressings. 25th. The ligature which was applied around the artery, in the groin, came away this morning. In the early part of November the patient left the hospital, the wound being nearly healed.

The hemorrhagic disposition, in this case was very remarkable, and appears to have affected all the arteries of the stump. The hemorrhage which occurred after the inguinal artery was tied,

probably proceeded from the branches of the gluteal and ischiatic arteries; and, on this supposition, it was Dr. Mott's intention to have secured the primitive iliac artery, if the patient had not been so much prostrated by the last hemorrhage as to have rendered any operation unjustifiable at that time. The recovery of the patient was contrary to the prognosis of all the attending surgeons.

No. VII.—AUGUST 30, 1830. CASE OF AXILLARY ANEURISM IN WHICH THE SUBCLAVIAN ARTERY WAS SUCCESSFULLY SECURED IN A LIGATURE. By *Valentine Mott, M. D., &c.* (See the *American Journal of the Medical Sciences*, Philadelphia, 1830, Vol. VII., p. 309–311.)

William Hines, aged twenty-eight, of Smithville, Virginia, came to New York August 24th, 1830, and became my patient.

The account he gave of his case was, “that about seven weeks ago he received a violent strain while carrying a canoe on hand-bars across the arms, which was followed by an extensive discoloration of the skin of the right arm, extending to the chest, and attended with considerable pain. It however yielded to the usual remedies in such cases. Three weeks subsequent to the accident he observed a swelling about the size of a pigeon's egg under the right arm, which had rapidly increased.”

On examination I found a tumor about the size of a goose egg, and decidedly an aneurism of the axillary artery. His general health being good, I directed him to keep quiet, to be bled, and to take some purgative medicines; and fixed on Monday, the 30th, for tying the subclavian artery.

At 11 o'clock, A. M., he was placed upon the table, with the shoulders elevated and inclined to the right side. An oblique incision was made, two inches in length, through the integuments and platysma myoides muscle, and corresponding to a middle line of the triangular interval formed on the inner side by the scalenus muscle, on the outer by the omo-hyoideus, and below by the clavicle. The cervical fascia was next divided to the extent of an inch, and with the fore-finger and the handle of a knife, the adipose and cellular tissues were put aside, and the artery readily exposed as it passes from between the scaleni muscles. After denuding the artery a little of the filamentous tissue with a knife rounded at the point and cutting only at the extremity, a ligature was conveyed around it, from below upward, by the *American needle*, and the artery tied a little without the scaleni muscles.

No other ligature was required. The patient lost less than two tea-spoonfuls of blood. The operation lasted about fifteen minutes, and was performed, with the assistance of Drs. Vaché and Hosack, in the presence of Drs. Barrow, Kissam, Rogers and Wilkes. The wound was closed by two stitches and adhesive straps; the arm was immediately wrapped in cotton wadding; no diminution of temperature took place.

8 P. M. Found the patient comfortable; says he has less pain in

the arm than before the operation; heat rather more than natural; a faint pulsation in the right radial artery; pulse 88.

31st, Morning. Passed a comfortable night after taking fifteen drops of the sol. sulph. morphine, which was given to allay the pain about the elbow, and which he considered rheumatic, having had more or less of it for some time previous to the operation. This pain was no doubt caused by the pressure of the tumor upon the brachial plexus. Pulse 70; skin natural; says that he feels very comfortable.

Evening. Complains of headache; directed a saline cathartic; pulse 90; skin pleasantly moist; pulsation in the right radial artery occasionally very distinct and regular; temperature of the right arm a little higher than that of the left.

September 1st. Pain of the arm obliged him to set up most of the night in an easy chair—after the operation of the salts, took again fifteen drops of the morphine, and slept quietly about five hours. Feels at present very comfortable; pulse 75; not the least evidence of febrile disturbance in any of his symptoms.

2d. Feels much more comfortable than yesterday; slept composedly all night; little or no pain in the arm; pulse 80; removed the wadding from the arm, and enveloped it in flannel, which keeps it very comfortable.

3d. Slept well all night after taking his dose of morphine, and feels very well to-day; pulse 74; pulsation of the right radial more regular and distinct.

4th and 5th. Continues to improve.

6th and 7th. Every way comfortable; right radial pulsates regularly, though more feeble than the left.

9th. Dressed the wound and removed the stitches; mostly healed, except where the ligature from the artery passes out. Pain in the arm for some days past has not been felt; makes no complaint; pulse in the radial artery very distinct and regular with the actions of the heart.

11th. Dressed the wound, which looks remarkably well; everything appears very favorable.

14th. On removing the dressings to-day, the ligature came away; all promises well.

20th. Wound being just closed, permitted him to walk about the room, and to take his usual allowance of food; aneurismal tumor much diminished in size, and very hard.

27th. Left the city to-day on his return by water to Virginia.

When I reflect on the disease for which this operation was performed, and upon the situation, importance and size of the vessel which was tied for its removal, it appears to me almost incredible that but twenty-seven days should have been required for its cure. That it should have succeeded is particularly grateful to my feelings, inasmuch as it was first successfully performed by an American surgeon,* and is an additional proof of the triumph of surgery over disease and death.

* Dr. Wright Post, of New York.

No. VIII.—APRIL 25th, 1831. CASE OF DIFFUSED FEMORAL ANEURISM, FOR WHICH THE EXTERNAL ILIAC ARTERY WAS TIED. *By Valentine Mott, M. D., Professor of Surgery in the College of Physicians and Surgeons. (See the American Journal of the Medical Sciences, Philadelphia, 1831, Vol. VIII., p. 393–397.)*

The external iliac artery has been so repeatedly tied with success, that perhaps, the only interest attached to this case is the obscurity which attended its diagnosis. Whilst the leading features of its history, as well as the condition of the tumor, and the absence of some of the most prominent symptoms of aneurism were strongly indicative of the presence of matter, the situation of the wound and the location of the swelling, induced me to suspect the existence of the last mentioned disease.

Not the least pulsation could be felt, and it was not until *visible motion, communicated to the hand by the tumor, and the cessation of it on compressing the artery above*, were observed *whilst viewing it obliquely*, that I could form any opinion upon the nature of the disease. This, together with the situation of the cicatrix and pulsatory thrill communicated through the stethoscope, decided, in my estimation, its aneurismal character, and determined me on tying the vessel. The result of the case will show that opinion to have been correctly founded.

Charles Fordham, aged 13, came under my care April 23d, on account of a tumor of his right thigh. The history given of it by the parents of the lad is as follows. On the morning of March 18th, while he was at school, a pen knife slid off the desk at which he was sitting; when clapping his knees suddenly together, to save it from falling, the blade pierced his right thigh, a short distance above the knee. On withdrawing the knife, it was found to have penetrated to the depth of an inch. Little or no blood escaped from the wound. Soon after the occurrence of the accident, he walked home, a distance of about twenty rods, but was so faint as to be obliged to stop twice on the way. In the afternoon the thigh became painful, and was uniformly swelled. It continued gradually to enlarge for about a week, at the end of which time a throbbing sensation was felt throughout the thigh, and an obscure pulsation was *thought* to be occasionally perceived near the wound by one of the attending physicians, who expressed his belief that the femoral artery had been opened. Both the throbbing sensation and the supposed pulsation, however, subsided in an hour or two, and chilliness, followed by fever, supervened. The pain in the thigh was aggravated, and the boy complained also of severe pain in his back.

An abscess was now supposed to be forming; accordingly poultices were kept constantly applied to the thigh and purgatives occasionally administered.

Under this treatment the swelling progressively increased until the end of the third week after the accident, when it became softer

and appeared to be subsiding. In the mean time, chilliness and fever at intervals returned, and the pain in his thigh and back continued, to relieve which anodynes were freely given. The tumor again increasing, the lad was brought to this city, and placed under my care.

At my first visit, April 23d, I found the patient much emaciated, and complaining chiefly of numbness, alternating with a burning sensation in his foot.

The thigh was enlarged to nearly twice its natural size, being occupied by a tumor which extended from the inside of the knee to the groin. It was most prominent in the middle of the thigh, where it was also softer than at the circumference. The integuments covering the tumor were nearly of their natural colour, but œdematous.

The leg and foot were in the same condition. The cicatrix showing where the knife had entered, was situated directly over the point at which the femoral artery perforates the triceps adductor muscles.

Fluctuation could be distinctly felt in almost every part of the tumor, but after the most careful examination, not the slightest pulsation could be detected either in the tumor or in the arteries of the leg. Pressure made upon the artery at the groin had no apparent effect upon the size of the swelling.

Under these circumstances I had determined to puncture the tumor, and in the event of its being aneurismal, to tie the external iliac artery, as the extent of the tumor precluded an operation below Poupart's ligament.

But on the following day, a very feeble motion was perceptible in the hand, when firmly placed upon the tumor and viewed obliquely, which ceased upon compressing the inguinal artery.

On visiting the patient the next day, the very visible motion communicated to the hand, especially when placed over the cicatrix, and the evident pulsation in the tumor, conveyed through the stethoscope, decided me in the opinion of its being an aneurism and upon tying the artery.

The operation was performed at 5 o'clock, P. M., 25th April, with the assistance of Dr. VACHE, and in the presence of several of my medical friends, according to the method recommended by Sir ASTLEY COOPER, which has been so frequently executed by myself and others, and the manner of doing it so well known, that to specify the steps of it is unnecessary.

The limb was enveloped in cotton wadding as is usual, and the patient put to bed. R. Sol. sulp. morph. gtt. xvi.

26th. Passed a better night, his mother thinks, than before the operation. Pulse 128. Says he has less pain. Foot and leg of a natural temperature. For some time before the operation he suffered from a burning sensation in the bottom of the foot, which was relieved by wetting it frequently with cold vinegar or applying to it a bottle of cold water.

This sensation left him soon after the operation, and at present he says there is only a sensation of numbness, or as though the foot was asleep.

In the evening, being restless and uneasy, took his usual dose of forty drops of laudanum.

27th. Says that he feels better than before the operation—had a comfortable night. Bowels being confined, took a dose of ol. ricini, which operated three times—pulse 108—skin natural—foot of natural temperature—tumor of the thigh visibly diminished—upon the more prominent part of it the skin appears wrinkled.

28th. Diminished the quantity of anodyne a little—passed a good night—feels no pain—pulse 118—limb naturally warm.

29th. Is very comfortable—took less of the anodyne last night—bowels open—pulse 112—tumor evidently diminished—limb naturally warm—upon looking at the foot, discovered a blister on the under part of the ball of the great toe, about the size of a dollar, with a little redness around the margin. Passed a lancet into it and evacuated the water.

30th. No more vesications and no spreading of the first. Removed the cuticle to the full extent of its detachment, and to my great grief, found it below livid and cold. The foot and toes naturally warm—slept well and feels better than yesterday—pulse 120—bowels open—directed him some Madeira wine in his food and drink, and to apply over the livid part frequently in the course of the day, some warm bals. Peru.

Eight P. M. Has taken more food and with an appetite—livid spot less in size than in the morning, and evidently has resumed a natural warmth. Directed to continue the same means as in the morning, with the anodyne at bed-time if necessary.

May 1st. Passed a good night and feels better than yesterday—pulse 128. The bottom of the foot appears the same as last evening. At a small point near the extremity of the great toe, and at the under part, the cuticle is detached about the size of a shilling, but the subjacent integument is of a healthy red colour—foot and leg of a proper degree of warmth. To continue the same treatment.*

2d. Was somewhat disturbed in the night by a noise in the house which prevented sleep—complains of no pain—pulse 120—bowels open—no change in the foot—same application to be repeated.

3d. Says he has a more natural feeling in the foot and leg than before the operation—he can now feel when the sound foot touches the diseased one, which he could not for some time previous to the operation. His symptoms and pulse the same as yesterday.

4th. Slept very well—appetite good—feels and looks better—pulse 110. Bowels regular—temperature of the foot natural—bottom of the foot better—swelling of the thigh less.

5th. Line of separation of the slough at the bottom of the foot very evident—feels well in every respect—pulse 112—bowels open—urged to take a nourishing diet and to use porter and wine in moderate quantities.

* The mother now informed me, that a bottle of very hot water had been applied to the foot, by the attendants during the night preceeding the day on which the first blister had appeared, which greatly diminished my apprehensions of the result.

7th. Very comfortable—separation of the slough in the bottom of the foot progressing, pulse 116; œdema of the foot and leg much diminished.

10th. Fourteenth day from the operation, dressed the wound—all healed by the first intention, except the openings made by the ligatures. Removed the three sutures and two of the ligatures; pulse more frequent than usual, in consequence of his feelings being much excited by his father leaving town. In all other respects he is as well as before. Slough at the bottom of his foot rapidly separating, it appears to be no deeper than the corium—directed to continue the balsam to the foot, and take nourishing diet with porter and wine.

15th. Improving very much in general health—slough from the bottom of the foot came away to-day—the granulations look very healthy—wound entirely healed at every part except where the ligature passes—ligature does not yet appear to be detached from the external iliac—œdema of the foot and leg mostly disappeared.

29th. Ligature from the external iliac came away to-day—aneurismal tumor about half removed—ulcer on the great toe healed—that on the bottom of the foot nearly closed—general health much improved. Left the city to-day for his residence in the country.

The American Journal of the Medical Sciences, Philadelphia, 1833; vol. XII., p. 274, speaking of this case, says:—

Dr. Vaché, in a letter we have recently received from him, informs us that the patient in whom Dr. Mott tied the external iliac for the cure of diffused femoral aneurism, and an account of which was published in our 8th volume, has done well and enjoys perfect health.

No. IX.—SEPTEMBER 22d, 1831. CASE OF ANEURISM OF THE RIGHT SUBCLAVIAN ARTERY, IN WHICH THAT VESSEL WAS TIED WITHIN THE SCALENI MUSCLES. By Valentine Mott, M.D., &c. (*See the American Journal of the Medical Sciences*, Philadelphia, 1833, Vol. XII. p. 354–359.)

IN the early part of September, 1831, I was requested to visit Mrs. B——, a lady, twenty-one years of age, in reference to a tumor situated in the lower part of the neck. The history of the case was briefly as follows:—A year or two before, she had been thrown from a gig, and received a violent contusion of the right shoulder and left side of the body, from which she had gradually recovered with the exception of a fixed pain in the injured shoulder, and the subsequent appearance of a small throbbing tumor above the collar-bone. Her physicians had informed her of its character, and the object of her visit to New-York was to place herself under my care and abide by my judgment. On examination, I found a tumour as large as a hen's egg on the outer edge

of the *scaleni* muscles, and immediately over the subclavian artery. Its pulsations were unequivocally aneurismal, and left no hesitation as to the correctness of the opinion already given on the nature of the disease. Her general health was considerably impaired, and the tumor was rapidly increasing in size.

With no other precedent than Dr. COLLES' case,* and aware of the uncertainty that must ever attend the result, of putting a ligature amidst large collateral branches upon a great vessel so near the heart, I deemed it a duty to explain to my patient, her husband, and her friends, the critical situation in which she was placed, and leave it for them to decide on the course to be pursued. In a few days I was informed of her resolution to take the chances of the operation, and fixed on the 22d of September for its performance.

At 12 o'clock on that day, she was placed upon a table, having taken an hour previously *sol. sulph. morph. grt. xx*. The shoulders were elevated on pillows, with the head thrown backward, and the face and body inclined to the left side. An incision was begun at the lower part of the outer edge of the sternal portion of the *mastoid* muscle, and carried upwards about two inches, and another from the commencement of the first along the upper surface of the *clavicle* of the same extent. The triangular flap, and a corresponding portion of the *platysma myoides* with its investments, were separately dissected from their connexions and turned aside. The *clavicular* portion of the *mastoid* muscle was next severed immediately above its insertion, and reflected upon the neck. This laid bare the deep-seated fascia, which was raised with the forceps and divided a little below the course of the *omo-hyoid* muscle and outside of the deep *jugular* vein. Upon enlarging this opening an inch downward, the adipose and cellular tissues were readily pushed aside, and the *scalenus anticus* exposed to view. Desirous of tying the artery, if admissible, on the *acromial* side of this muscle, I passed a finger carefully down upon its outer edge, but found from the vicinity of the tumor, that it would be best to secure it on the *tracheal* side, and avoid all disturbance of the parts in that situation. Accordingly, the cellular substance was separated with the fingers and handle of the knife, and the subclavian exposed just within the *thyroid* axis, the branches of which could be plainly seen. The filamentous tissue was raised from the artery with the forceps, and cautiously divided with a small scalpel, and the ligature conveyed under the vessel from below upward by the American needle. In accomplishing this part of the operation, curved spatulas were used to separate the wound, and a blunt hook to draw the deep *jugular* towards the *trachea*. The knots were readily made with the fore-fingers. Pulsation in the aneurism and vessels of the arm immediately ceased.

The detached parts were restored, and the integuments retained by the interrupted suture and adhesive straps. Three small arte-

* The patient died on the eighth day after the operation. See the particulars, in the *Edinb. Med. and Surg. Journ.* for January, 1815.

ries were tied—no vein was cut that required a ligature—about four table-spoonfuls of blood were lost.

Dr. VACHE assisted me in the operation, and it was performed in the presence of Drs. PARKIN and HOWARD, and a number of my pupils. The patient sustained it remarkably well, and did not evince any particular sensation, or effect when the artery was tied.

Evening. Has vomited several times, which she attributes to the morphine taken in the morning; right hand and arm warmer than natural; has a little reaction of the heart and arteries; complains of pain in the right arm and side of the neck; radial artery feels full, but has not any pulsation in it.

23rd, morning. Passed a comfortable night; the vomiting was allayed by mint tea; arm warmer than natural, and feeble pulsation in the radial artery; pulse 88, soft; still feels pain in the arm and neck.

Evening. Complains of head-ache; pulse the same; skin moist and not heated; temperature of both arms alike, counted eighteen feeble pulsations in the right radial artery. The pulsation of the carotids being unpleasant, recommended the head and shoulders to be elevated on pillows.

24th. Pain in the neck and arm less than yesterday; head-ache continues; skin natural; tongue a little furred; temperature of the limb natural; pulse the same; counted nine or ten pulsations in the radial artery in a minute, but more feeble than yesterday. Directed a Seidlitz powder to be taken at intervals until the bowels are moved.

Evening. The aperient has operated but once; pulse 70; only a slight tremulous motion to be felt in the radial artery; has had several turns during the day of cool hands and feet, followed by flushes of heat, and attended with some feeling of weight about the chest; violent pain in the head, with a flushed countenance; pain in the arm less, and in both arms alike. Took eight ounces of blood from the left arm, which relieved her unpleasant feelings immediately.

25th, morning. Has slept but little during the night, notwithstanding the relief afforded by the bleeding. Complains of pain through the upper part of the right shoulder and base of the scapula, and occasional sensation of a tingling or creeping motion in the arm to a painful degree; pulse 80; skin natural; no distinct pulsation in the right radial artery, but tremulous as yesterday. Seidlitz powders to be repeated.

Evening. The medicine has operated freely; has had some sleep; head-ache much less; pulse 80; skin moist and natural. Complains of great pain in the upper part of the right arm, also deep in the neck and extending to the spine, between the scapulæ; says she has pain in swallowing and in taking a full inspiration. Advised her to take seven drops Sol. acet. morph.

26th, morning. Has slept well, and feels much better; breathing good; head, back, shoulders, and arm free from pain; pulse 80; skin natural and moist; tongue white. Pulsation in the radial artery more distinct; counted forty-one beats in a minute.

Evening. Says she has passed a very comfortable day. No alteration since the morning. Directed ten drops of the Sol. acet. morph. at bed-time.

27th, morning. Did not pass as good a night as the preceding; pulse 74; arm and body of natural temperature; pulsations of the radial artery fifty in a minute.

Evening. About the same as in the morning; bowels have been moved by some ripe fruit eaten during the day. Ordered thirteen drops of the morphine at bed-time.

28th, morning. Feels much better; very little pain in the shoulder, and none in the arm; pulse 79; pulsation in the radial artery more distinct, and beats sixty-one in a minute.

Evening. Only complains of a trifling pain in the shoulder, such as lying in one position occasions; pulse 75; in the right arm 71 distinct beats in a minute. The wound discharging a little sanious fluid unpleasant to the patient, removed the bloody lint and part of the plasters, and re-dressed the wound; it looks very well.

29th, morning. Omitted the morphine last night and slept well; in all respects better; pulse 72; in the right arm 69.

Evening. The same as in the morning; number of pulsations in both arms alike, but much more feeble in the right.

30th, morning. On being carefully raised up in the bed in order to take nourishment, after a little irritation from the absence of the nurse at the moment when wanted, she suddenly called out to a relation in the room and said that she was bleeding. About two table-spoonfuls of dark-colored blood were slowly discharged. It ceased on a little pressure; pulse 76 in both arms; removed the lint, and dressed the lower part of the wound, which looks well; gave eight drops of Sol. acet. morph.

Evening. At eight o'clock, four table-spoonfuls, as near as could be judged, were again discharged from the wound, and at 12 perhaps a tea-spoonful more. It was of a dark color, and was readily checked by pressure.

October 1st.—Feeling sick at the stomach this morning, some Cologne was poured over the epigastric region, which immediately occasioned a chill that lasted half an hour. During it she vomited several times. Considerable increase of heat and other attendants of the hot stage continued during the day. Pulse 100 in both arms.

Evening. Febrile disturbance still continues; pulse the same; no further discharge of blood from the wound.

2d, morning. Complains of soreness of the throat; febrile excitement still continues; pulse 110, rather tense; directed Epsom salt in Seidlitz powders.

Evening. Salts have operated twice, and she feels better; has had several rigors during the day, and vomited several times; pulse 104, somewhat tense; took $\frac{3}{4}$ xviii. blood from the left arm with manifest abatement of the symptoms; the blood upon standing exhibited strong evidences of inflammatory action; it was very buffy and much cupped.

3d, morning. About 10 o'clock last night, had a trifling oozing of blood from the wound, after a hard turn of hawking; was comfortable afterwards, but did not sleep much; complains of headache; for two hours past, has been in a free and easy perspiration; pulse 100, soft; says her throat is very painful in deglutition; the left tonsil is swelled; directed a dose sulph. magnesia.

Evening. Has had a severe ague which lasted about fifteen minutes, during which she vomited; heat that followed very considerable; perspiration very copious for several hours; wound has discharged a small quantity of blood twice since morning; medicine has operated on the bowels; pulse 108; febrile heat much less. Whilst sitting by the bed-side and preparing to dress the wound, four table-spoonfuls at least of florid arterial blood were suddenly discharged; on removing the plasters and lint it as suddenly ceased.

4th. Between the hours of four and five A. M., had an ague, which continued half an hour, accompanied with vomiting, heated skin, and profuse perspiration. Delirium commenced with the chill, and continued more or less until ten o'clock. Directed to take on the subsidence of these symptoms, one tea-spoonful of the following medicine every hour until another chill supervened:—

R. Sulph. quiniæ,	.	.	.	grs. xxiv.
Acid. sulph. arom.	.	.	.	3 ij.
Sirup. simplicis,	.	.	.	3 ij. M.

In the afternoon between four and five o'clock, a slight chill came on, attended with vomiting; the fever which supervened was mild, and early in the evening the quinine was resumed. At 10 P. M., the wound was dressed; looks very well; no bleeding since last night; pulse 100.

5th. Had a slight chill about midnight, and is now, 10 A. M., laboring under a similar one; pulse 110. The bitterness of the preparation of quinine being very offensive to her, ordered instead of it one grain of the sulphate in pill every hour; as soon as perspiration came on. Dressed the wound; two tea-spoonfuls of blood appeared to have been discharged; says her throat is much better, and a cough which was quite harassing yesterday has left her.

Evening. Has had her clothes changed, and been removed into a clean bed; perspiration left her in a great measure about noon, and she has had a refreshing sleep.

6th, morning. Passed an excellent night; towards morning had slight sensation of the chill and much less fever; pulse 108; directed more nourishment to be given and the quinine continued.

Evening. Has had still less chill and fever in the early part of the afternoon; dressed the wound; compress stained with perhaps a table-spoonful of blood.

7th. Had a very comfortable night; feels but little pain in the shoulder this morning; tongue beginning to clean off; has not had any ague since yesterday; feels some appetite; pulse 100. Quinine continued.

8th. In all respects better; had a slight sensation of coldness this morning; fur upon the tongue much cleaned off; appetite greatly improved; no bleeding since the evening of the sixth; wound looks well; all of it healed except a small part above the clavicle through which the ligature passes; pulse 104; continues the quinine.

9th. In the early part of last evening, after a quiet day, she was attacked with hemorrhage. The discharge was sudden and to the amount of a pint; it stopped spontaneously. The effect was great and alarming; she was pale, cold, almost pulseless, when I reached her. In about an hour she rallied, but was restless and disturbed; any form of anodyne was declined. About midnight, three or four table-spoonfuls more of blood were lost.

At six o'clock this morning, a profuse gush took place, accompanied with a jet and whizzing noise; I thought it the moment of dissolution; she again revived. Her mind is calm, and she is resigned to the event; no more hemorrhage occurred. She lived until the afternoon of the tenth, and died without a struggle.

NO. X.—DECEMBER 29TH, 1834. ANEURISM of either the Ischiatic or Gluteal Artery, in which the RIGHT INTERNAL ILIAC ARTERY WAS SUCCESSFULLY TIED. By Valentine Mott, M.D. (See the *American Journal of the Medical Sciences*, Philadelphia, 1837, vol. XX., p. 14—15, reported by Dr. W. C. Roberts, of N. Y.)

Richard Charlton, the patient, is a colored man, born in this city, and about 38 years of age. He has worked in a grocery store. He first felt the symptoms of his disease in the summer season of 1832;—during the cholera then prevalent he had a diarrhœa, and while making frequent straining at stool, perceived a swelling and pulsation in the right buttock, which has gradually increased until this time. It is now about the size of a goose egg, and contains only fluid blood.

On the 29th of December, 1834, at noon, I proceeded to tie the right internal iliac artery, in the presence of Drs. J. Kearney Rodgers and A. E. Hosack, and assisted by Drs. Vaché and Wilkes. The incision which was fully five inches long, extended from a spot on a line with the umbilicus, about midway between the linea alba and the anterior superior spinous process of the ilium, to within half an inch of Poupart's ligament, and then curved forward an inch over the course of the spermatic chord. The operation lasted about forty-five minutes, owing to the almost unrestrainable intractability and frantic restlessness of the patient. His great straining and jactitation caused me to make a small opening in the peritoneum, whilst separating it from the iliacus internus muscle. The peritoneum and intestines being drawn up and supported by a large curved spatula, the internal iliac artery was readily seen, crossed by the ureter, which was easily pushed aside. The filamentous tissue was quickly separated by the fingers from about the vessel, and the ligature conveyed under it by the Am-

erican needle. At the moment of tightening the knot the hand was applied to the tumor, in which all pulsation immediately ceased, and which itself almost entirely disappeared directly after. The patient, being put to bed, took twenty drops of a solution of morphine, and in the evening was easy.

December 30. Had a good night's rest, and was comfortable in the morning. Some excitement coming on early in the afternoon, he was bled from the arm to about $\frac{3}{4}$ xvij., and took a solution of sulph. magnes. in divided doses. *Evening*—Much easier; salts had not operated. Directed an enema, and applied a strip of blister plaster around the wound.

31st. Has had a good night; is doing well; is free from pain, and the pulse is tranquil; enema operated several times, and the plaster drew well. In the evening he was still better than in the morning.

January 1st, 1835. Feels much more easy than he did yesterday, and can move better—the abdomen is less tumid. Pulse not more frequent, but rather quicker than it was yesterday. Since the enema was administered has had frequent teasing stools. Ordered enema *opii c. amylo.* Cold water and barley tea for drink.

2nd. Anodyne enema quieted the bowels. Pulse, though still frequent, soft and compressible; tension and tenderness of abdomen gone.

3rd. Freedom from tenderness continues; pulse nearly natural. Re-applied the blister and allowed panada and arrow-root.

4th. Much depressed by the intense cold of to-day, (10° below zero of Fahr.)

6th. Pulse natural; tongue nearly clean; is cheerful and hungry.

7th. No unpleasant symptom whatever.

9th. Removed the sutures from the wound, which is very much closed. Is free from pain; pulse natural and bowels regular.

The report of the case terminates here; and owing to the absence of Dr. A. E. Hosack, upon whom the case of the patient devolved, we are only enabled further to state that the ligature came away on the 42d day.*

NO. XI.—APRIL 11, 1844. CASE OF LIGATURE OF THE SUBCLAVIAN ARTERY ABOVE THE CLAVICLE, FOR ENORMOUS DIFFUSED FALSE ANEURISM OF THE WHOLE UPPER EXTREMITY FROM THE ACROMION TO THE FINGERS, FROM A GUN-SHOT WOUND, followed by a complete cure. By Valentine Mott, M. D., Professor of Surgery in the University of New-York. (See *New-York Journal of Medicine*, Langleys, Publishers, Vol. IV., No. 10, p. 16—19, Jan., 1845.

C. R. M., aged thirty-five years, by trade a machinist, of Kingston, Ulster county, New York, of a bilious temperament and sober habits, whilst on a hunting excursion with a friend, had occasion to pass through a thicket, and, in the act of stooping to clear away

* I have seen this patient within the past year in excellent health. Dec., 1845. V. M.

some bushes which impeded his progress, the gun of his friend accidentally went off, lodging its contents (buck-shot) about the inferior angle of his scapula. Two of the balls passing obliquely through the axilla, were extracted from the anterior portion of the arm; twelve had been previously removed by means of poultices, from about the place of entrance; two were still to be felt under the integuments, below and about the middle of the clavicle.

At the time of the accident the patient was not stunned, nor did he experience a sensation of numbness in any part of the arm. In the course of a few hours, however, a tumor began to appear in the axilla, and continued to increase until the third day, when, for the first time, pulsation was detected. It was not until the sixth day, when, after a paroxysm of pain, extending through the whole arm, and so excruciating as almost to render him frantic, that he experienced a sensation of numbness through the entire limb. The paroxysm lasted about one hour, during which time he was obliged to take over one hundred drops of laudanum.

This was followed by an œdematous swelling of the arm, obliging him to sleep seated in a chair, with his arm placed on a pillow before him. The paroxysms of pain returned for two successive days at about the same hour, with the same violence, and lasting about the same length of time. This was followed by a violent burning sensation in the palm of his hand, which continued until some time after the operation was performed. This was the only sensation that remained in the whole limb.

He was now brought to the city and placed under my care, being the twenty-second day from the time of his receiving the injury.

On my first visit, I found the œdema to extend from the shoulder to the extremities of the fingers. So great was the extravasation in the axilla, that the circumference of the upper part of the arm was found to be about twenty-eight inches.

On the day of the operation (11th of April, 1844,) the condition of the arm was such as clearly showed that no time was to be lost. The cuticle was detached to a considerable extent on the most prominent part of the tumor in the axilla; the skin was cracked, and from it there oozed a thin sanious fluid. In short, it presented the appearance of a slough, produced by the application of caustic.

Operation.—The patient being seated in a chair, with his arm and shoulder depressed as much as the condition of the parts would admit of, an incision of about three inches in length was made through the skin, extending from the anterior border of the sternocleido-mastoid muscle one inch and a half above the clavicle, in a direction downwards and outwards towards the acromion process of the scapula. The superficial fascia and platysma myoides being successively exposed and divided, a mass of extravasated blood was brought into view, which entirely obscured the subjacent parts. On the patient making attempts to swallow, a prominent line, extending in a direction upwards and inwards, was observed in this confused mass, which, after a little dissection, proved to be the omo-

hyoid muscle, but of a much darker color than natural. The deep cervical fascia being now cut through, the subclavian artery, accompanied on its external and superior side by one of the cords of the axillary plexus, appeared just where it emerges from behind the scalenus anticus muscle. An aneurismal needle, armed with a strong silk ligature, was now passed round the vessel, the point of the instrument being directed outwards and backwards, so as to avoid the subclavian vein. The artery being then tied, the edges of the wound were brought together by two interrupted sutures and adhesive plasters.

In the course of this operation, two or three small vessels, branches of the transversalis humeri and transversalis colli arteries, had to be taken up. The external jugular vein was divided, and tied on each side of the wound.

Progress of the Case. April 12.—Patient says he has felt much more comfortable since the artery was tied; the tension and weight of the arm having greatly diminished. On taking a view of the upper part of the arm and shoulder, the attention was at once arrested by the general reduction in its size; the skin was softer and more natural. About the elbow it has also subsided, but the œdema of the fore-arm and hand are about the same. Temperature of the arm has remained about natural since the operation, but at present the heat is a little augmented. By accurate measurement, taken before the artery was tied, and again to-day, there is about three-quarters of an inch abatement in the size of the aneurismal tumor in the axilla and under the pectoralis major muscle; lividness of the axillary part of the tumor much less than yesterday. Pulse 117; tongue and skin natural.

Owing to the frequency and irritability of his pulse, I directed him, since he came to the city, to take a good nourishing diet. This he is requested to continue. Also, to keep the arm wrapped up in cotton wadding.

April 13.—General expression of his countenance much improved—says he feels much better; temperature of the arm and hand about natural; more œdema of the hand; diminution of the tumor a quarter of an inch, by actual measurement, since yesterday. Pulse 101. General irritability of the system lessened. Directed him to continue the same diet.

April 14.—Pulse 100. Œdema of arm gradually subsiding, that of the hand remaining nearly the same; temperature of the limb nearly natural: the size of the tumor has diminished half an inch since yesterday: feet being œdematous, I put on a bandage, and directed him to keep his legs in a horizontal position.

April 15.—Patient expresses himself, this morning, as being more comfortable, and says that he has passed the best night since the operation, having remained in his easy chair in a reclining position. Temperature of the arm natural; dimensions of the tumor and shoulder the same as yesterday. Pulse 94; appetite good.

On the under part of the fore-arm, near the elbow, some threat-

ening of ulceration was visible before the operation. This arose from the pressure and weight of the limb. As some redness extended from it over and about the olecranon, he was directed to cover over the whole with an emollient poultice.

The most projecting part of the tumor is at the axilla, which was quite livid before the operation, continues now to have the cuticle cracked, and is oozing a watery, and somewhat purulent fluid; it is quite soft and fluctuating to the touch.

The lint over the strips of plaster covering the wound, being somewhat saturated with matter, was removed, together with the adhesive straps which retained the edges in contact. Most of the wound, except at the outer extremity, is united by the adhesive process.

April 16.—Better than since he received the injury; is a little excited by a visit from several of his friends from the country. Pulse 100; appetite good; slept very well during the night; tumor in the axilla discharges from the cracks a sanious fluid.

April 17.—In all respects as comfortable as yesterday; more of his friends visited him to-day; pulse eight or ten beats, more frequent than yesterday; directed him to be kept more quiet; dressed the wound; it looks well.

April 18.—Does not look so well; says he did not have a good night's rest; was not in any pain, but could not get into the right position; is sleeping from time to time during the day; pulse 120; arm of the natural temperature; circumference of the tumor the same as yesterday; a small quantity of dark grumous blood is being discharged from the most prominent point of the aneurismal swelling in the axilla.

Sense of feeling begins to return in the arm from the shoulder to the elbow; it is accompanied with a painful sensation when the finger is passed over it. Directed him to continue his nourishing diet, take porter, and if his restlessness requires, to take his teaspoonful of laudanum.

April 19.—Found him this morning in a recumbent position on his couch. At my urgent request, he, yesterday afternoon, went to bed, previous to which he was somewhat incoherent, and now says that he hardly knew what occurred yesterday.

Passed a much better night, looks and expresses himself as much better than yesterday; œdema of the fore-arm, hand and feet, much diminished. Aneurismal tumour discharged dark-colored blood in small quantities; size, the same as yesterday; pulse, 103, soft, and free from the irritability it had yesterday, and for sometime before the operation. This more tranquil condition of his vascular system is to be ascribed to the exclusion of his friends since yesterday.

April 20.—Passed but an indifferent night, not being able to relieve himself by any change of position; feels better, however, to-day than for several days past. Dressed the wound, which is granulating very well; removed the second suture and two of the ligatures; circumference of the aneurism diminished one quarter of an

inch since yesterday : it continues to discharge from the most prominent part of the tumor ; œdema of the hand and fore-arm much diminished. Indeed, the whole extremity begins to assume a much more natural appearance ; tongue clean ; appetite better than for two days ; pulse 94.

April 21.—Passed a better night ; the tumor has not undergone any perceptible change since yesterday ; œdema of fore-arm and hand is gradually diminishing ; pulse, 84 ; temperature of hand nearly natural.

April 22.—Tumor in the axilla has discharged more freely since yesterday : all his symptoms are ameliorated ; dressed the wound ; looks well ; another ligature came away ; pulse 86.

Sense of feeling in the arm increases gradually ; it has now extended to the elbow. In the fore-arm and hand sensation and motion are entirely abolished.

April 24.—Is sitting up, and says he is in all respects much better ; dressed the wound ; it is granulating beautifully ; removed the other ligature from the external jugular vein ; pulse ninety-six ; appetite good ; sleeps well, without his accustomed tea-spoonful of laudanum.

April 26.—Says he feels constantly improving ; dressed the wound ; much filled up since the last dressing ; ligature from the subclavian came away, having separated spontaneously ; pulse ninety-four ; more grumous blood discharged from the tumor ; scab upon the apex of the aneurism about the size of a dollar.

April 28.—In all respects improving ; wound looks very well ; but for the weight of his arm, he would feel perfectly well.

May 2.—Wound nearly healed ; walks about the room ; in all respects improved.

May 16.—Greatly improved in appearance ; feels in all respects very well ; eschar from the tumor in the axilla came away spontaneously yesterday, leaving a fresh surface of coagulated blood. There was an increased flow of grumous blood when it came off ; it was about the circumference of a dollar, and nearly half an inch thick ; it had remained on about twenty-eight days ; it was composed of black grumous blood, very hard, dry externally, and cracked.

June.—Has continued to improve regularly ; is permitted to return home.

After the first slough of integuments took place, it was curious to watch the steps of nature to prevent hemorrhage. As one eschar would come away, another would very quickly form, to plug up the opening ; it would be many days in separating, and had the appearance of a regular slough from the application of caustic ; it was, however, a thick layer of the grumous and lamellated blood of the sac.

In this way, plug after plug of hard coagulated blood would form and be cast off, and then there would be a pretty free discharge of this grumous blood, with some coagulated portions. The sac was gradually evacuated in this way until all its contents were

removed, and a fresh granulating surface was left, which readily healed up.

November.—Came to the city to see me ; appearance of the whole arm very natural ; sensation and motion considerably restored in the fore-arm and fingers.

Those interested in the advancement of surgery in our country, may, perhaps, be gratified to learn that this is the fourth time that I have put a ligature around the subclavian artery above the clavicle, on the acromial side of the scaleni muscles. All the operations have been attended with success.

APPENDIX TO CHAPTER OF V. MOTT.—FIRST SUCCESSFUL APPLICATION OF THE LIGATURE TO THE LEFT SUBCLAVIAN WITHIN THE SCALENI MUSCLES.

Since the foregoing chapter was prepared for this work, a case occurred in the New York Hospital, in which Dr. Jno. K. Rodgers, one of the surgeons of this institution, determined to undertake this important operation, never hitherto performed by any person.

The patient was a German of middle age, with an aneurismal tumor, apparently about the situation where the left subclavian passes under the scalenus anticus muscle.

At a full consultation of all the surgeons and consulting surgeons of the hospital, (myself included among the latter,) it was concluded after a free expression of opinion, to leave the case to the discretion and judgment of the surgeon, (Dr. Rodgers,) under whose care the patient came.

I may observe, however, that at the consultation mentioned, I gave it *as my opinion, that although the artery in question, could undoubtedly be tied by a careful and well informed surgeon, I nevertheless, considered that it was improper so to do.* I founded my opinion in this case: 1st, upon the relative anatomy of the left subclavian artery in the whole of its course within the scaleni muscles, and its intimate association with the internal jugular vein and the thoracic duct; 2nd, upon the result of all the operations which had been performed upon the *right* subclavian *within the scaleni muscles*; this latter operation having been performed four times, and all the cases having terminated fatally by secondary hemorrhage.

A fortiori, it was my opinion that the ligature on the *left* subclavian from the anatomical relations stated, would make this operation still more hazardous. Insomuch that I remarked then, and still reiterate the assertion as my belief, that I do not think it a *justifiable* operation, and would not perform it myself.

This case of Dr. Rodgers, the only one in which a ligature has ever been applied to the left subclavian within the scaleni, terminated *fatally* by secondary hemorrhage; the ligature having been applied, as we understand, just below the origin of the vertebral artery. The case with the *post mortem* appearances will, we learn, be given by Dr. Rodgers himself.

Dr. Rodgers of *New York*, has then, the satisfaction of knowing that he has been the *first* to apply a ligature to this great artery.

I may add that I regret for the honor of American surgery, that this first attempt of a ligature on the left subclavian within the *scaleni*, has not been crowned with success. V. M.

Supplemental Note on Aneurisms.

Dr. J. Kearney Rodgers, of New-York, informs me that he has tied the internal iliac with perfect success in a case of complicated aneurisms, which he has not yet published, but of which he promises the particulars in time before this volume is issued from the press. The external iliac and the femoral were also both tied in this patient !

We also hope to receive in time for this volume the same surgeon's account of a ligature upon the *left subclavian*, above noted in Dr. Mott's chapter. Dr. Rodgers says the ulceration which caused the secondary hemorrhage in that case was, as has been observed by Sir A. Cooper, Mr. Vincent and others, (see *Cooper's Surg. Dict.*, Reese's Amer. edit., 1842, art. Aneurism, in Appendix,) after all operations for aneurisms, on the distal side of the ligature, and involved also the vertebral artery in this instance, from the ligature having been placed very near its origin.

The classification of *aneurisms* of Mr. Luke, (see a note *supra*), is, in some parts, not new. The *sacculated* form, with *pouches* with greatly attenuated coats, (of which a specimen exists in the Hunterian Museum,—the sac ulcerating into the pulmonary artery,) is noticed by Mr. Guthrie, (*Diseases of Arteries*.)

Breschet (*Différentes Espèces d'Anéurismes*), adopts this variety, and makes also three others, viz., the *fusiform* or spindle-shaped, the most usual ; the *cylindroid*, where the artery is sometimes dilated uniformly through a track of one or two feet, observed by him in the arteries of the limbs, brain and splanchnic cavities ; in which cylindroid aneurisms he includes the aneurism by anastomosis of Jno. Bell, and erectile tumors of Dupuytren. Another variety of Breschet is the true *varix-like aneurism*, where the artery is tortuous and also studded with small sacculated tumors.

Both the *primitive carotids* have been tied also in the same patient, with an interval only of *twenty-seven days*, by Professor Kuhl of Leipzig, (See Crosse in *Prov. Med. Chir. Trans.*, vol. V.,) for a pulsating tumor, involving nearly the whole scalp, from a wound in the occiput. The case was perfectly successful. The heaviness and throbbing in the head, produced by such operations, as was found to be the result in this case, required copious venesection.

Dr. Mussey of Cincinnati, (State of Ohio,) has also tied *both primitive carotids*, after an interval of only twelve days, for an enormous *nævus* on the vertex, (*American Journal of Medical Sciences*, Philadelphia, 1838,) which, however, had but little effect on the tumor, the radical cure of which was not accomplished until the *nævus* was excised, an operation which required forty ligatures ! This makes *five* cases in all of ligature of both carotids.

Dr. T. S. Kirkbride (*American Jour. of Medical Sciences*, 1839,) has met with eminent success in curing wounds of arteries by direct compression, having succeeded in this manner in five cases, where the brachial, radial or femoral were implicated.

The *internal iliac*, according to the *London Gazette*, has been also tied by Dr. Thomson of Barbadoes, but the case ended fatally.

Dr. Gross, in his *Western Journal of Medicine and Surgery*, for June, 1841, states that he has tied the *right subclavian* artery for axillary aneurism, and that the ligature came away, and the patient did well, until the contents of the sac made their way by ulceration into the thoracic cavity, and caused death. He enumerates in all *twenty-six* cases, in which this artery has been tied, *seventeen* of which were attended with a successful result. T.]

THE LIGATURE ON THE PRIMITIVE ILIAC.

The *common* or *primitive* iliac, as will appear by the following summary, has been tied up to the present year, (1845,) no less than **TWELVE** times. Thus:—

1. If the case of Professor Gibson, now of the University of Pennsylvania, at Philadelphia, (see account which follows,) is not excluded by its imperfect details, it was the first on record, the operation being performed at Baltimore on the 27th of July, 1812, Professor Gilson being then a resident of that city. The patient died on the 13th day from peritoneal inflammation, perforation of the intestines, &c.

Dr. Gibson states (*Amer. Med. Recorder*, Vol. III., 1820, p. 185, &c.) that while at Baltimore during the political riots there, and himself in the midst or near by the belligerent parties, he was suddenly, July 27th, 1812, called to a laboring man close by, aged 38, who had just the moment before received a musket-ball in the left side of the abdomen, causing profuse hemorrhage. He placed his finger in the wound, and succeeded in arresting the hemorrhage partially, and thus kept his finger as well as he could in the same position, and walked by the side of the man while he was being carried home. Though this occupied but a few minutes, the hemorrhage could not be stopped, and was profuse and exhausting. Nevertheless, the surgeon still holding his finger *in situ*, (probably the left index,) he operated *instantly*, with the other hand, in presence of Col. Mitchell, U. S. Army, Drs. Owen, Hall, &c., dilating the wound rapidly up and down, and finally, by great efforts, succeeded by means of an eyed bent probe, in applying two ligatures on the vessel. The circulation was soon restored to the left limb; but the peritoneum having been wounded, and the intestines perforated, and also requiring ligatures, the inflammation proceeded to such extent from these causes, and from the quantities of blood effused, that with the almost incessant hemorrhages, followed by an enormous distension of the abdomen, death was inevitable; though to the surprise of all, he lived 15 days. The surgeon found the upper ligature, which he had believed to have put on about half

an inch below the bifurcation of the aorta, had now at least slipped off, leaving the gaping, unclotted, ununited orifice of this vessel in the midst of masses of effused coagulated blood in the cavity of the pelvis and abdomen. The other ligature was on firm in the same trunk, immediately above the bifurcation into the external and internal iliacs. A jury's inquest, in the then tumultuous times, interrupted any further examinations. So this case is left in too much obscurity to serve any more than as a point for suggestion, not a landmark to be depended upon. The bullet was found imbedded in the upper and left side of the sacrum. There was no adhesion of the sides of the artery under the ligature which was found on it.

Dr. Gibson justly supposes that there can be no reasonable hope of success in wounds of the primitive iliac, even though the surgeon be on the spot; but he suggests the fact of the circulation being restored in this case, and the patient living so long, as valuable data to serve as ground-work for the prospect of success in the deliberate application of the ligature in aneurisms of the external and internal iliac.

The continuance of life, after the interruption of a column of blood so large as that of the primitive iliac, was not, however, an event to be unanticipated, and need not have occasioned any surprise in the mind of Dr. Gibson after the full knowledge he had of the fair prospect of cure that followed, for weeks, the ligature upon a much larger trunk, and one so near the heart, (the innominata,) which Dr. Mott had tied in 1818. Dr. Gibson considers his operation the *first* ever performed on the primitive iliac.

2. Dr. Mott's case, 1827. [Vid. his account of the same, in his chapter on *Aneurisms*, &c., *supra*. Also article *Aneurism*, by Mr. Wardrop in the *Cyclopædia of Practical Surgery*.] The ligature came away on the 18th day, and the patient recovered.

3. Sir Philip Crampton, of Dublin, for aneurism of the external iliac, 1828. Death on the 4th day, from hemorrhage. It is to be regretted, says Mr. Richard Hey, (*Medico-Chirurg. Transactions*, London, 1844, Vol. XXVII., p. 326,) that the common *silk* ligature was not used in this case, as a different result probably would have ensued, (see also *Ib.*, *Medico-Chirurg. Trans.*, London, Vol. XVI.)

4. Mr. Liston, of London, 1829, for secondary hemorrhage after amputation. The patient, a boy aged eight years, died very soon after. (*Ib.*, *Medico-Chir. Trans.*, London, Vol. XXVII., p. 326.)

5. Mr. Guthrie, of London, for supposed aneurism of the gluteal. The patient recovered, but died eight months afterwards from another cause, as it was found no aneurism existed, (*Ib. ib.*) but a medullary tumor, (*Philadelphia Medical Examiner*, Vol. I., 1842, p. 645-647.)

6. M. Salomon, of St. Petersburg, 1837, cured.

7. Mr. Syme, of Edinburgh, 1838. Death on the 4th day.

8. M. Deguise at the Hospital of Charenton, near Paris, 1840. Cured.

9. This operation was a second time performed successfully in America, at the Pennsylvania Hospital, Philadelphia, by Dr. Edwd. Peace

of Philadelphia, for a case of right inguinal aneurism, Aug. 29, 1842, in a laboring man named Israel Jones, who about five months before had strained his groin while lifting a heavy stone. A few days after, appeared a hard tumor of the size of a pea, which in a month increased to the size of a walnut, and in four to five months acquired its maximum growth, two inches in height, and five and a half inches both in its transverse and its vertical diameters, the tumor being of an irregular hemispherical form, involving nearly all the right external iliac, and two inches of the right femoral, causing latterly such constant and distressing pain night and day as to deprive him of sleep, and oblige him to sit up with his leg flexed on the thigh, and this latter on the pelvis. The patient was an excellent subject, in the prime of life, robust, temperate, and uniformly healthy.

Dr. Peace commenced with a semi-elliptical incision, seven inches long, and extending from over the anterior superior spinous process of the ilium obliquely downwards, to within half an inch of the external abdominal ring, and nearly parallel to Poupart's ligament. The integument, the fascia of the external oblique, the external oblique, and the fascia of the internal oblique, were divided with the bistoury. The transversalis and internal oblique muscles were now exposed, and with the aponeurosis were divided on a director. The peritoneum was then separated with some difficulty, and the vessel brought into view.

The vessel, says the account published by M. C., (See the *Philadelphia Medical Examiner*, Vol. I., 1842, Philadelphia, p. 645, 646, 647,) was taken up about half an inch above the bifurcation, the ligature being passed around it VERY READILY by means of Gibson's needle. Pulsation and pain in the tumor ceased immediately; followed as quickly by numbness of the limb and foot, and insensibility, particularly of the toes. The numbness continued occasionally for the first two weeks. Sensibility of the parts, however, was *entirely restored* after the 3d day, even down to the toes. The limb below the knee became sensibly cold an hour after the operation, but by an envelop of carded wool, recovered its natural temperature down to the ankle, in the first twelve hours, and to the foot in twenty-four—the toes only remaining below the proper standard of heat. The heat then augmented in the limb to excess; so that for the first two weeks it was warmer than the sound one, except in the toes, which did not reacquire a proper temperature until after the sixth day. About the middle of the second week, the patient complained of severe pains darting from the toes up into the tumor, which, however, was relieved by lint wet with laudanum.

The tumor, soft until now, became much more dense and decidedly smaller. Some tumefaction of the limb on the fifteenth day soon subsided. The wound was dressed on the fourth day, and daily afterwards. The discharge was healthy and moderate, appetite excellent, and general health improved. One half the wound was united by the first intention, and the whole wound, except the sinus occupied by the ligature, had cicatrized within the first two weeks.

The ligature came away, Sept. 27th, the *thirty-fifth* day. Friction with soap liniment gave great relief to the numbness and pain.

There appears to be a discrepancy in the above account as to the simultaneous existence of numbness and sensibility in the limb.

10. The tenth case was performed by Mr. Richard Hey, surgeon to the York County Hospital, (see his account in *Medico-Chirurgical Transactions*, London, 1844, Vol. IX., second series, p. 325—332,) Dec. 2d, 1843, at Acomb, near York, with the sanction of his brother, Mr. W. Hey, of Leeds. The aneurism had suddenly appeared in the beginning of November, and had increased in the course of *two* or *three* days from what seemed to be a cluster of enlarged hard glands, to such considerable size as to give great pain along the crural nerve, and in about three weeks from its first appearance, had acquired the size of a *large pulsating* tumor above Poupart's ligament, leaving no doubt of its being an aneurism of the external iliac. This was the situation of the patient, a Mr. Taylor, on the day of the operation, which latter was decided upon immediately, from the evidently imminent danger of the tumor bursting. The tumor occupied the whole of the left iliac fossa from below Poupart's ligament, to within little more than an inch from the umbilicus; the vertical diameter was six inches, the transverse six and a half, and the swelling projected at least three inches from the plane of the abdomen. The tumor had all the usual characters of aneurism.

Mr. Hey commenced with an incision from two inches and three quarters above the umbilicus to the base of the tumor, being about six inches in length, and moderately curved; this was afterwards extended, by an angular continuation, an inch and a half in length; it was also exactly three inches to the left of the median line. The fibres of the external and internal oblique and transversalis muscles were successively divided; and the transversalis fascia having been readily raised with a director, was carefully opened, to an extent equal with that of the external incision. The peritoneum, which now protruded, being depressed and drawn towards the opposite side, the surgeon slowly insinuated his fingers behind it so as to separate it from its cellular attachment to the adjacent parts. "The common iliac," says Mr. Hey, "was easily reached, and its compression with the finger instantly stopped the pulsation in the tumor. A little time was occupied in scratching through the sheath of the artery; a common silver aneurism needle was now passed under the artery, armed with a double ligature of stay-maker's silk waxed. By holding aside the peritoneum and viscera, a momentary view of the artery was now obtained, and its complete isolation ascertained. The ligature was then tightened with the fingers close down upon the artery, when the pulsation entirely and finally ceased. The situation of the ligature was, I believe, an inch below the bifurcation of the aorta, or very little more." The wound was closed with sutures and strips of adhesive plaster, and over the whole was placed a coating of lint dipped in strong mucilage. The operation was performed in twenty-five minutes. Though little

or no blood was lost, and no vessel had to be tied, much exhaustion ensued. The wound, upon the whole, healed favorably, and the ligature came away the 28th day after the operation.

The limb at first was three degrees lower in temperature, but on the third day two degrees warmer than the other. On the fourth day both limbs were of equal temperature, and so continued. One source of anxiety was a constant sense of *distension of the bowels, accompanied with violent spasm, especially when the bowels were moved*, and which was but partially relieved by the use of aperients and anodyne injections. "On the 4th of January, (33 days after the operation,) these symptoms assumed," says Mr. Hey, "a very serious aspect. No action of the bowels could be obtained, the attacks of spasm were most distressing, the abdomen was tympanitic, and the patient became quite exhausted, slight coma denoting his dangerous condition." On attempting to empty the bladder with the catheter, so much obstruction was found, that the rectum was explored and found to be distended with an enormous mass of feces, resembling to the feel the presentation of a child's head in labor. This mass was perfectly dry and hard, and with difficulty broken down; after being removed, the alarming symptoms subsided immediately, showing how imperiously obligatory is the *medical treatment* of surgical cases. Mr. Hey thinks the pressure of the aneurismal sac on the colon prevented the contents of that viscus from descending into the rectum, thereby causing a gradual and formidable accumulation, and which was at length suffered to descend by the progressive absorption of the fluid in the sac. On Jan. 20th, the patient was restored to his usual health, and enabled to take daily *walking exercise*.

The above highly interesting and remarkable case, and which was communicated to the Royal Medical and Chirurgical Society, by Sir Benj. Brodie, Bart., April 9th, 1844, becomes still more so from being "the first case (according to Mr. Hey) which has occurred in that country, (England,) in which aneurism of its branches has been cured by tying the common iliac artery." [The **FIRST** successful operation of a ligature upon the *primitive iliac* having been performed by Dr. Mott. See *supra*.]

Mr. Hey calls attention to the extraordinarily rapid growth of the tumor, which in the short space of *three weeks* had acquired the dimensions above described. He seems to incline to Sir Philip Crampton's mode of making the incision, and says he sees no reason to doubt the practicability of successfully tying the aorta itself; the more so from the number of instances in which that vessel is found obliterated after death.

11. Of the eleventh case of ligature on the primitive iliac a brief account only has been given at one of the sittings of the Royal Medical and Chirurgical Society of London, March 11th, 1845, (London *Medical Gazette*, March, 1845, p. 805, 806, 807, 808,) at which sitting Mr. Edward Stanley, surgeon of St. Bartholomew's Hospital, states that he tied the primitive iliac on a patient of that hospital, aged 42, for a *pulsatory tumor of bone on the ilium*. This

is a species of tumor of bone, where the internal structure appears, according to this surgeon, to be converted into blood-cells and blood-vessels, continuous with some neighboring artery of large volume; the pulsations being rendered in such tumors more distinct from their dense elastic structure. In other tumors of bone, the vicinity of a large arterial trunk alone gives the pulsation. Mr. Stanley alludes in the case in question to the *little value* to be attached to the *bellows-sound* in the diagnosis between *aneurism* and the pulsating tumor of bone.

The tumor in the case under consideration had its chief attachment to the left ilium and projected from both surfaces of the bone. It reached, says Mr. Stanley, downwards to Poupart's ligament and to the extent of about three inches into the abdomen. It felt moderately firm, and a little below the crista, near the anterior superior spine, a small moveable piece of bone was discovered apparently involved in the tumor. Everywhere within reach of the fingers the tumor pulsated, not *with a thrill or vibration*, but with the *deep, heavy beat of aneurism*. By the ear resting against the abdominal parietes, a bellows-sound was plainly recognised.

Mr. Stanley shows the impotency in England, as here and everywhere, of auscultation: here with a tumor within the grasp of all, the opinions of the surgeons predominated in favor of its being an aneurism; but whether of the external or internal iliac no one could say. At all events the primitive was the trunk to be tied, which operation without giving any of the details, he states that he performed Jan. 27, 1845. The case proceeded favorably to the middle of the second day when peritonitis came on, and the patient died on the morning following that of the third day from the operation. The effects of peritonitis were observed in the deeper parts and left side of the abdomen. A small medullary tumor of the size of a filbert was found in the wall of the left ventricle of the heart. The pelvic tumor was composed of spongy tissue with cells and convoluted vessels distributed through it. There was also a tumor on the inner side of the right upper arm of the size of a small orange, which was loose and free of pain or pulsation. It had existed ten years, and had ceased to grow. It was found identical in structure however with that in the pelvis. Some medullary matter was found in the bronchial glands and lungs.

There was clearly, too deep-seated a vitiation in the constitution and fluids of this man to warrant, as we think, a ligature on the common iliac, the apology for which in this case is the fatal delusion created by the fallacies of *auscultatology*; for the vaunted *bellows-sound*, a *sound* which charlatanerie in this country has *blown* to some profitable results to its own cupidity, led to the diagnosis of an aneurism. The surgeon, from the peritonitis which ensued, thinks the safest method of reaching the vessel would be through the posterior abdominal parietes.

12. Mr. Fergusson, at the same sitting, showed similar disastrous results while he was at Edinburgh, from depending on the pretended disclosures to be obtained from murmurs, bruits, cooings,

raspings, &c., whereby pulsatory pelvic tumors near large trunks are mistaken for aneurisms; Mr. Syme himself having been thus deceived in a case which he supposed an aneurism of the external iliac. After he made the incision to tie the common iliac or external iliac, he found his mistake and removed the tumor, but the patient died. Mr. Fergusson spoke of a case in which during similar doubts as to a tumor in the course of the external iliac, at Edinburgh, the *common iliac* was tied and the tumor did in reality prove an aneurism, but the patient died—no date is given. This must however make a twelfth case. So for the total we have *twelve cases, six cures and six deaths*; but by no means a *criterion* for pure aneurismal cases.

CASE OF ANEURISM OF THE BASILAR ARTERY.

One of the most clearly defined and interesting cases of this rare affection, is by an American surgeon.

We are indebted to Dr. Ruschenberger, surgeon of the U. S. Navy, and now surgeon of the United States Naval Hospital, East Brooklyn, (King's County, Long Island, State of New York,) for the details of a remarkable case of *basilar aneurism*, recently observed by him in his extensive practice in our naval service. This case may be considered the *only* one of an aneurism of the basilar artery on record, which has been unequivocally established; the others we have alluded to, [in the text *supra*,] or which have been spoken of by various authors, being altogether too imperfect or confused in the descriptions to allow of our giving that credence to their statements which it would be desirable we should be enabled to do, in regard to an abnormal deviation so remarkable and important as that of the arterial circulation of the encephalon.

Christian Wahlman, marine, admitted May 25, 1845, for "paralysis," from the U. S. S. Lexington.

Left side paralysed; ptosis of left eye; no control of sphincters: urine required to be drawn off; *tongue turned to the left side*; unable to sit up without support; difficulty of deglutition; intellect clear but slow. When sitting up there was an antero-posterior vibration of head and body, and at all times when awake, the right leg, foot and arm were in constant motion, so that the *right side* seemed to be suffering from chorea, while the left was paralysed. Thus while the power of the *motive* nerves on the left side appeared to have undergone a sensible diminution in their energy, that of the *motive* nerves as well as the sentient of the right side seemed to have acquired a morbid intensity.

[This case will be reported in the American Journ. of Medical Sciences for 1846, by W. S. W. Ruschenberger, M. D., U. S. N.]

Autopsy fourteen hours after death.—Dr. Ruschenberger continues:—

"Limbs flexible; great development of the sub-cutaneous cellular tissue; countenance of nearly a natural color. Brain found in a

somewhat softened condition, and an effusion, amounting to perhaps a pint, completely inundating the organ and filling up the ventricles. When the anterior part of the corpus callosum was torn, there was a jet-d'eau of perfectly limpid serum of three inches in height, from contraction of the cavities containing the fluid; over the pons varolii an *aneurismal enlargement of the basilar artery* the size of a pigeon's egg was revealed. The sac contained a very *hard dry clot of blood*, but notwithstanding this the communication with the artery was easily traced; an extravasation of blood from rupture of the sac had taken place into the substance of the pons which was *considerably softened and of a black color*.

The viscera of the abdomen were healthy: thorax was not examined.

The day was excessively hot; thermometer 92, and the sick list large, which prevented the thorax from being inspected.

Dr. Ruschenberger, informed me, in a recent conversation with him, that the aneurismal tumor was situated in a position as nearly central as could be imagined upon the *basilar process* of the occipital bone, just before the junction of the two vertebral arteries which form the basilar trunk. The tumor which was, as has been mentioned, of the size of a pigeon's egg, the long axis of which was in a *vertical* position, of course pressed upwards upon the pons varolii, and rose to a level with the posterior clinoid process (*sella turcica*,) of the sphenoid bone. It must of course have made pressure in all directions, more especially upon the middle lobes at the base of the brain, and consequently upon those portions of the cerebrum which give origin to numerous important nerves.

The jet-d'eau of limpid serum came probably from the lateral ventricles, which latter consequently must have been greatly distended. The pressure of the aneurismal tumor had probably caused this effusion, and the pressure of the *distended lateral ventricles* on the surrounding parts of the brain, and the origin of nerves, is to be taken into the account, as an important element in the production of the symptoms described.

Some reflections naturally arise from this most important case of aneurism communicated by my friend Dr. Ruschenberger: If the great pathological principle, that pressure upon the origin of the nerves of the encephalon on the right hemisphere, causes paralysis and other abnormal results on the opposite side of the trunk and limbs, and vice versâ, (which pathological axiom I have no reason to call in doubt) then the aneurismal tumor in this case, *central* as its position appeared to be, must have produced more lesion on the right side of the portions of the cerebrum; which is furthermore confirmed by the existence of an augmented muscular activity on the *right* side, as is evinced by the co-existent symptoms of chorea.

I had occasion some few years since to examine at the Hospital of the Poor of this city at Bellevue, (while Dr. Vaché was physician of that establishment,) a remarkable case of *chorea*, which in contradistinction to that above described by Dr. Ruschenberger, may be denominated *rotatory chorea*. The patient would for hours or even

days, as Dr. Vaché said, continue to make rotatory movements of the head from side to side, incessantly, and from one side to the other, or vice versâ, according as the first movement was communicated by the surgeon either to the right or left.

I do not know whether this patient is still alive, or if dead, whether any autopsy has been made; but Dr. Ruschenberger's valuable case, allows us to infer, that there may have been in this patient of Dr. Vaché an aneurism of the *basilar artery*.

Practitioners therefore should direct their attention to these facts; and in all cases of *chorea* and *paralysis*, search in their post mortem examinations for aneurismal or other tumors at the base of the brain.

The *retraction of the tongue to the left side*, is an important point to be noted in the case of Dr. Ruschenberger. In our note on *fractures of the base of the brain*, and especially of the petrous portion of the temporal bone, (infra,) it will be seen that much important light has been thrown upon that subject; and that in such lesions, it is now contended, that the retraction of the *uvula* and *velum* to one side or the other, may serve as an important diagnostic mark to denote injury to the opposite side of the encephalon at the base of the brain. For it has been found, it will be seen, (if the statements are correct) that the motive functions of the *uvula* and *velum* are derived from the *portio dura* pair of nerves; and that consequently when one of this pair is injured, the parts mentioned (*velum* and *uvula*) will by the integrity of the nerve on the opposite side be drawn to the opposite side of the lesion, the antagonism of the muscles on that side no longer having any force to counterbalance its action. In the case in question, the *tongue*, it appears, was drawn to the *left side*; which was the side of the body affected with *hemiplegia*. It is consequently another argument in support of the idea we have thrown out, that the greatest degree of lesion, so far as pressure on the nervous centres of sensibility at the base of the brain, were concerned, must have been on the right side.

THE IMPORTANCE OF THE PERUVIAN ASTRINGENT PLANT, MATICO, IN ARRESTING HEMORRHAGE.

Dr. Ruschenberger, of the U. S. Navy, has also kindly communicated to me the following important observations in respect to the value of this new American remedy. The case was one of consecutive bubo in each groin, in a patient aged about 35, who had been cured of chancre. The buboes on each side had been evacuated freely, and had been for some time burrowing under the skin and fasciæ of the groin; each having an external opening with the usual characteristic ragged, leadish-blue-colored shelving edges, so peculiar to and diagnostic of these cases. In dilating them, which is Dr. R.'s constant practice, and the only true and sound treatment, as our own experience testifies, he divided in both, as it so happened, the *arteria ad cutem abdominis*, which on both sides, singular as it may appear, had taken the same sub-cutaneous course in the groin over

the sinuous passages of each bubo, and having become much enlarged, bled freely, and per saltem. The assistant of the hospital, after some hours, finding it difficult to suppress this hemorrhage, Dr. Ruschenberger directed the application to the dilated wounds and cut ends of the arteries, of the celebrated Peruvian astringent plant, *matico*, (the *Piper angustifolium* of Ruiz and Pavon.) This was first attempted by the dried leaf entire moistened; but without effect. The surgeon then himself broke up a portion of it into powder between his fingers, and having moistened it with water, applied this paste into the wound. The bleeding in both arteries ceased *instantly* and did not return.

It may be well to remark that Dr. Ruschenberger was the first who brought this valuable styptic from Peru to this country, viz., in 1834. He has used it, he informs me, beneficially in gonorrhœa, leucorrhœa, and chronic diarrhœa; and in ophthalmia, where *astringents* are required. He has given it in doses internally of 5 grains to half a drachm, three times in 24 hours. In a case of *hematemesis*, where every thing had failed, this astringent, in five grain doses, (meaning always the powdered dried leaf) three times a day, effected a perfect cure.

The story told of its discovery is this: that in 1824, at the battle of Ayacucho (Bolivia, in South America,) a soldier having had his leg shot off, gathered up the *Matico* that grew around the spot where he lay and applied it to the bleeding stump; by which means the hemorrhage was immediately arrested, and a cure effected. Hence its name of *yerba del soldado*.

Dr. Ruschenberger last summer, (1845,) derived most satisfactory results from the external application of the *matico* in a case at the U. S. Naval Hospital, of a marine who had received a gunshot wound in the neck about an inch below the right commissure, about 14 months before, at Montevideo (South America). The ball had knocked out all the molar teeth of the lower jaw on the right side, and lodged near the root of the tongue, lying there very superficially. It was extracted without difficulty. There was a hard fistulous opening, however, an inch below the angle of the lower jaw, communicating with the base or root of the tongue. Ascertaining with the probe the presence of a foreign substance there, he dilated the wound and extracted to his surprise a *molar* tooth! But in doing this the surgeon must have divided, as he thinks, the *internal maxillary artery*, as the bleeding was profuse and for some time uncontrollable, owing to the difficulty of getting hold of the cut end of the bleeding vessel, from the indurated state of the parts. It then occurred to him that he would use the *matico* directly to the wound, which he promptly did in the manner above described. It acted like a charm, and arrested the hemorrhage immediately.

Some remarks touching the value of this hemostatic remedy, as communicated by Dr. Ruschenberger, may be read with advantage in the Journal of Pharmacy of Philadelphia, year 1844, the details thereof being drawn up by Professor Carson of the College of Pharmacy of that city.

Dr. Ruschenberger, in his communication to me, suggests that it would be important to ascertain whether the matico might not be of great value in cases of *secondary hemorrhage*, which are always so embarrassing and frequently so fatal after surgical operations.

CURE OF ANEURISM BY COMPRESSION.

Since the publication of the valuable Memoir of Dr. Bellingham of Dublin, (see our note above,) another triumphant case, making the *thirteenth*, has been added to the list; and what makes the case more important is, that the treatment was simplified down to the purest principles of the admirable plan established by the surgeons of Dublin, as we have already described it in the note just alluded to. The case was communicated by Mr. W. Newcombe to the Surgical Society of Ireland, (See *Dublin Journal of Medical Science*, March, 1845, p. 157,) and was one of popliteal aneurism. Two *clamps* only were used, one on Scarpa's space and the other higher up the limb, and tightened alternately with the first when that produced uneasiness. No bandage was applied to the limb or over the tumor.

Dr. Bellingham has well remarked in a former essay on compression as a cure for aneurism, (*Dublin Journal of Medical Science*, 1843,) that when it was considered absolutely necessary for the success of compression, that such an amount of pressure should be applied as was almost certain to produce sloughing of the part, and very certain to occasion intense pain and suffering to the patient; and when in addition, this was to be prolonged through five successive nights and days; we can readily understand why patients refused to submit to it, and we can easily account for the disrepute into which the practice fell, and for the unwillingness of surgeons to adopt this treatment, in preference to the simple operation of placing a ligature on the femoral artery.

But even Dr. Bellingham, as recent as that date, (1843, July,) was yet disabused of the ancient and now proved erroneous treatment of Valsalva by bleeding, low diet, &c., which he conceived to be still absolutely essential as accessories to compression. Dr. Bellingham even believed that bleeding would aid in the coagulation of the blood. We have no doubt he now sees the evils of such practice, and is convinced that the modern doctrine now so rapidly gaining ground is the true one, to wit, that without pretending to advocate a stimulating course, the reverse of the exhausting treatment of Valsalva, that is, a nutritive generous diet is the one that must now be adopted, as the only means in fact of promoting the formation of plastic lymph or fibrine in the blood.

SUCCESSFUL LIGATURE UPON BOTH CAROTIDS AT AN INTERVAL OF FOUR AND A HALF DAYS.

The only successful case on record in this country that we are aware of up to the present time, of a ligature on *both carotids* after a

short interval of time, is that of Dr. Mott, (See his chapter, p. 288, supra,) in which both carotids were tied in an interval of 12 months.

In another attempt of this kind by the same surgeon, in which there was an interval of only *fifteen* minutes, the case ended fatally.

We have now the pleasure of recording another triumph for American surgery, in the successful application of a ligature to both carotids after an interval of *four days* and a half, in a case of gunshot wound attended with secondary hemorrhage. This operation was performed in October, 1844, by John Ellis, M. D., a young surgeon of Grand Rapids, State of Michigan, and affords a gratifying evidence of the progress of surgical science in the new, and until within a few years, uninhabited regions of the vast fertile prairie country of this empire beyond the Alleghanies.

The case as recorded by Dr. Ellis (in Dr. Lee's New York Journal of Medicine and the Collateral Sciences, number for September, 1845 ; Langleys, proprietors and publishers ; Vol. V., No. XIV., p. 187, et seq.) states that the patient, Peltish Hill, aged 21, while hunting near Grand Rapids, received, Oct. 21, 1844, the contents of a rifle in his back. The ball striking near the centre and immediately above the spine of the scapula of the left side, and after making a flesh wound of about two inches and a half towards the neck, passed out, and after about the same space entered his neck over the centre and posterior edge of the sterno-cleido-mastoid muscle. It then passed up through the centre of his tongue, and out of it to the right of the median line, striking the lateral incisor, cuspidatus and bicuspidatus of the right side, which teeth it knocked out together with the alveolar process external to them. It then passed through the upper lip, leaving a ragged opening through it. Dr. Ellis saw the patient a few hours after the accident, and found he had lost but little blood. The surgeon drew the edges of the wound on the lip together with adhesive plaster and two or three sutures, and dressed the other wounds with cold applications. The patient suffered but little pain, but was entirely unable to swallow even liquids, owing, as Dr. Ellis thinks, to the swelling of the tongue. As secondary hemorrhage was apprehended, directions were given that the patient should be carefully watched night and day by two intelligent assistants, who were directed to compress the carotids and the orifice of the wound in case of need. Very little inflammation followed, owing doubtless, as the surgeon says, to the patient being unable to take any food for three days, at the end of which time some water and nourishment were injected into the œsophagus through a flexible catheter. The next day he swallowed some liquids with difficulty, and soon after recovered his powers of deglutition. On the seventh day Dr. Ellis was sent for during the night to visit his patient. A hemorrhage had taken place from the wound of the tongue, but was readily suppressed by compressing the carotid of the left side and the orifices of the wound ; and on removing the pressure no bleeding returned. The hemorrhage, however, returned in considerable quantities a few hours after, and was restrained with difficulty by compression.

The surgeon again sent for and arriving in the evening, applied with the assistance of Dr. Platt a ligature on the left carotid, below the omo-hyoideus muscle; which operation was attended with much difficulty, owing to the swollen condition of the parts, the necessity of maintaining pressure, the unfavorable position of the parts for the operation from the necessity of keeping the mouth in a certain position to avoid strangulation from the blood, and also from the inconvenience of being compelled to perform the operation by candle light. Arriving at the common sheath, the descendens noni, which was found in its usual place, was pushed aside, but on opening the sheath, the operator came in contact with a large nerve directly in front of the artery which seemed to him of unusual size for the par vagum. It was pushed aside, and on separating the artery and vein a little he saw no appearance of the par vagum in its usual place. A slight coldness of the face on the side operated upon, and an occasional throbbing beneath the sternum, were the only unpleasant symptoms that followed the tightening of the ligature. The patient did well until the eleventh day, when there was a return of the hemorrhage, which was easily controlled however by pressure on the right carotid and on the two orifices of the wound. A slight pulsation was now for the first time felt in the left temporal artery. The hemorrhage returned several times in the night and during the next forenoon; and as the patient could not endure pressure on the carotid, it was confined to the two orifices of the wound, producing there however a good deal of pain in the direction of the ninth pair of nerves.

In this dilemma Dr. Ellis, in consultation with Drs. Platt and Shepherd, being uncertain whether the hemorrhage was from the right lingual or from the *unligatured* end of the left carotid, and finding also, a good deal of tumefaction under the angle of the jaw, which rendered it difficult to identify the cornu of the os hyoides, determined to take up the right carotid: which was performed without difficulty. The internal jugular vein overlapped the artery to some extent, and the descendens noni and par vagum were found in their place. The patient being in the sitting posture, two ligatures were passed under the artery, and one of them *tied over a cork applied to the vessel*. A slight paleness ensued, together with cessation of the hemorrhage, and also of pulsation in both temporals. In an hour the pulse rose from 95 to 104, but soon came down to 110; there was no difficulty in breathing. The first ligature was cut over the cork and removed, the other tied and the wound closed with sutures and adhesive plaster. A hacking cough and difficulty of breathing came on at the end of 24 hours, with pain in the chest and heaviness, the pulse being 120 and rather full for his reduced state. *Twelve ounces* of blood were now taken from the arm and some by cupping, affording, however, little or no present relief. Some tincture of belladonna was given for the cough. Four or five hours after, there was more distress, pain, and difficulty of breathing, the pulse remaining about the same. A *drop* of the tincture of aconite was added to a glass of water, and

a tea-spoonful administered of this mixture. In four hours after he felt better and breathed easier; pulse 110 and less full. The aconite and belladonna were now given whenever the cough and dyspnœa required, while all other fluids were abstained from. The symptoms of difficult breathing subsided under this treatment, and the pulse came down in a few days to 80. Neither of the wounds healed by first intention, but commenced discharging a healthy pus. The ligature of the right carotid came away the 14th day, that of the left on the 17th. The wound on the left side continued to discharge for several weeks, when the portion of the artery between the wound and the ligature sloughed, and came away in three pieces at different times, the last portion being about one inch in length. The young man at the date of the communication, (June 18th, 1845,) was enjoying comfortable health and attending to business. No perceptible pulsation could be felt in either temporal.

Dr. Ellis, in conclusion, remarks:—

“There are several reasons which make the above case very interesting. It shows the comparative safety with which both carotids can be ligatured, so far as the brain is concerned, [a fact already established by Dr. Mott’s successful case,] and the danger of pulmonary congestion, [even after all the privation of blood, hemorrhage and venesection.] It shows also, with what rapidity anastomosing branches of the opposite vessel, supply blood enough to give rise to pulsation in the temporal artery, and of course the danger of hemorrhage from the unligatured end of the artery, [a point to which the attention of surgeons is so strongly directed by our author, M. Velpeau,] where it is not possible to ligature both ends of the wounded vessel.”

We have thus on record *five* instances of a ligature on both carotids:—

1. *Two* by Dr Mott.
2. *One* by Dr. Mussey of Cincinnati (Ohio.)
3. *One* by Professor Kuhl of Leipzig.
4. *One* by Dr. Ellis.

SECTION VI.

VENOUS SYSTEM.

The same operations are practised upon the veins as upon the arteries; this class of vessels in fact, like the arterial system, is liable to wounds, fungous degenerations, and hypertrophy.

Wounds.—The wounds of the venous system, however, unless they should be situated upon trunks of the first order, the vena cava, internal jugular veins, subclavians, axillaries, iliacs, femorals, or popliteals, rarely give rise to dangerous hemorrhages, and if they are formidable they are rendered much more so by the inflammation they cause, than by the loss of blood that proceeds from them.

Wounds of veins differ also essentially from wounds of arteries in cicatrizing with facility, without necessarily involving the obliteration of the wounded vessel. It results from this, that if a large vein is divided upon its side, and that compression is not sufficient to put an end to the hemorrhage, the ligature will not have to embrace its entire calibre. The most convenient and secure process in such cases, consists in seizing the two lips of the opening with the tenaculum, and in then passing a thread around the wound on the side of the vein, which thus cicatrizes without difficulty and without interposing any obstacle to the circulation.

When a vein is divided transversely, whether we compress it or apply a ligature to it, it rarely happens that it becomes necessary to act upon any other portion of it than the inferior extremity. However, it might be necessary to obliterate the other end also, if the wound was situated in the neck, in the upper part of the arm, or even in the fold of the groin. I have often seen the popliteal vein pour out blood copiously by an actual reflux movement.

When veins are found in the wounds of an amputation, it is generally useless to apply a ligature to them. Nevertheless, if they keep up a hemorrhage, I think we should do wrong not to tie them. The dangers of this ligature, upon which so many surgeons have insisted for half a century, are shown to be farthest from the truth, (vid. Process for tying the Carotid,) and I should not be surprsed to find that it would prove more advantageous to surround them immediately with a ligature, than to leave them free at the bottom of the wound.

As for the rest, almost all the operations that have been practised on veins, seem to have been devised for cases of varices. This article, therefore, will be devoted to the treatment of these affections.

CHAPTER I.

OPERATIONS REQUIRED FOR VARICES.

Though varices do not constitute a disease essentially dangerous, they may often so far incommode those who are affected by them, as to make it proper that surgical aid should be had recourse to for their treatment. The trouble, deformity, and ulcers that they cause or keep up, and the hemorrhages which sometimes take place from them, sufficiently explain the solicitude which they have occasioned at every epoch of the science.

ARTICLE I.—VARICES IN GENERAL.

The ancients, who employed topical applications, astringents, desiccatives, and resolvents for varices, used also the compressing bandage, applied to the whole extent of the limb, and professed to aid their action by means of internal remedies. Then, as at the present day, those different modes of treatment were nothing more than simple palliatives. To obtain a radical cure, they had recourse to operations properly so called.

§ I.—*Ancient Methods.*

A. *Acupuncture*.—Sometimes it was thought sufficient, in conformity with the recommendations of Hippocrates, and as was also advised by Paré and Dionis, to puncture the varices, (Hipp. *Traité des Ulcères*, à la fin,) and incise them lengthwise, but *more freely than in phlebotomy*, in order to empty them of their blood and clots. “Practitioners of the present day,” says De Gouey, (*La Véritable Chirurgie*, p. 236,) make use of a needle of gold or silver, with which they puncture these tumors to empty them of their blood; but this operation is but a feeble resource.”

B. *Cauterization*.—According to Avicenna, the vein should be seized with hooks at two points, distant three fingers’ width apart, then tied with a good silk thread, and divided transversely upon the space between the ligatures; after which, the ligature upon the lower end is to be removed, in order to bring the blood from below upwards, and to force out as much of it as is possible with the hand; then to cauterize the upper end of the vessel, and even the whole extent of the wound, with a hot iron or arsenic. Avicenna appears to have been the first, in the treatment of varices, who actually applied methodical compression from the foot to the knee.

Others tore out the varices, after having cut into them; this, at least, is what Ali-Abbas appears to recommend. Celsus (*De Re Med.*, lib. 7, cap. 31, Ou Ninnin, t. II., p. 371) speaks of cauterization and extirpation, and all the world know, from Plutarch, (*Hommes Illust.*, t. IV., p. 380, Trad. de Dacier,) that the stoic Ma-

rius—who, remarking that the remedy was worse than the disease, declined presenting his other leg, covered with varices, to the surgeon, who had removed them from the first—had undergone this last named operation. Dionis (*Operat.*, p. 766, 9e Demonstr.) is astonished that the ancients did not advise the hot iron to traverse (*barrer*) the varicose veins, as is done with horses, and that they should have been satisfied with the potential cautery. An enormous varix was cauterized and cured by Bidloo, (*Coll. de Villars, Cours de Chirurgie*, t. I., p. 434–439.) Bayrus (Louis, *Dict. de Chirur.*, t. I., p. 561) speaks of a varix that resembled gutta rosa, and which he cured by *cauterization of the frontal vein*. We are not surprised to see M. A. Severin (*Méd. Eff.*, p. 368, ch. 98, Exopirie) cauterize with the red-hot iron. Dionis admitted, however, that the roller bandage, in form of a buskin, (*bottine*), was preferable to all other means. This was also the recommendation of the greater number of the surgeons of our epoch, when an attempt was made, some years since, to simplify the operations of the Greeks and Arabs.

C. *Excision*, either simple, or as Celsus describes it, or as it must have been performed upon the leg of Marius, or combined with the ligature as in the process of Galen, or that preferred by Paul of Egina, (*Vid. Vidius, Comment sur Gal.*, lib. 6, cap. 83,) is but rarely necessary, and cannot be required, as Boyer remarks, but for those large tumors or varicose bunches (*pelotons*) which are sometimes met with in the legs; it is also uncertain if it might not even then be superseded with advantage by processes more simple. We may learn, from J. L. Petit, (*Œuvr. Chir.*, p. 266, 267, 279, 280,) the kind of hemorrhage to which patients may be exposed from the incomplete extirpation of varicose veins.

D. *The Ligature*, which was distinctly recommended by the ancients after excision, and which Dionis describes with much minuteness, (*Oper. Cit.*, p. 765,) was frequently employed by Ev. Home, in England, and by Bécclard in France. We take up, says M. Briquet, (*Thèse No. 193, Paris, 1824*), who relates the results obtained by Bécclard, a longitudinal fold of the skin on the point where the vein is alone and most superficial, and divide the fold down to its base; we then pass under the vein an eyed probe furnished with a ligature, and after having tied the same, divide the vessel immediately above it. We may also cut the skin and the vein at a single stroke, and then tie the lower end of the venous canal by seizing it with the forceps. Strips of adhesive plaster serve to hold together the lips of this little wound, and the patient is to be kept at rest.

MM. Smith, Travers, and Oulknow, have followed the method of Home; but not with as constant success. Physic, however, says, he has great reason to be satisfied with it, and M. Dorsey, (*Elements of Surgery*, Vol. II., p. 404,) who frequently made trial of it, affirms it, that it was never, in his practice, attended with any serious accidents. According to Briquet, at no time during the service of Bécclard at La Pitié, did this method ever produce an

unpleasant symptom, except in two cases, out of an aggregate of sixty persons operated upon. It is difficult, in fact, to understand how this ligature, if properly applied, could be attended with much pain, or be followed by tetanus, as has been pretended, or why inflammation of the vein, on the cardial side of the disease, should be more frequently caused by this than by any operative process, which causes the obliteration of the vessel.

The process of M. Gagnères, referred to by Maréchal, (*Thèse de Concours*), and which consists in passing a ligature around the vein through a simple puncture in the skin, would have no other effect than to render the operation more difficult without diminishing its inconveniences. "Nevertheless," says Chaumette, (*Enchiridion de Chirurg.*, liv. 1, cap. 58, p. 278,) "I am in the habit of introducing with less trouble and pain, and by means of a sharp, curved (crochue) needle, a ligature under the vein, then tying it and leaving the thread there until it comes away of itself." Does Lombard, (*Clinique des Plaies Recentes*, an VIII., p. 248,) where he relates that some recommend incising to the right and the left upon the side of the vein to avoid the inflammation which must ensue from puncture with the needle and insertion of the ligature; and that others call this inflammation in question, wish us to infer that they knotted the ligature upon the skin? De Gouey, (*Op. Cit.*, p. 237,) who tied the vein below the varix, and then divided it above, followed this practice with much success. Lombard, (*Op. Cit.*, p. 248,) who had recourse but once to the ligature, applied it at 6 or 7 millimeters below the tumor, inserting under the vein a needle of the shortest possible curvature, and laying a small compress of four double along the course of the vessel, in order to support the knot of the ligature, and render the whole secure. Afterwards opening the tumor, he dressed with a pledget of lint dipped in alcohol. M. Cantoni, (*Observateur des Sc. Méd. de Marseille*, Juillet, 1825, trad. par Gérard,) who relates twenty cases, four of which are taken from his own practice, and others from that of Vacca, Mori, and Orlandi, says, that after having made trial of the ligature, recision and excision, this last offers the most favorable prospect of success: but Vacca Berlinghieri, (Valentin, *Voyage en Italie*, 1re edit., 1825, p. 94, et trad. par Gérard, 2e edit., 1826,) who, in 1820, had already in six cases effected the cure of varices by the ligature according to the method of Home, *has seen the disease reproduced*, and some time after, having seen a man upon whom a surgeon had performed incision of the vein above the knee with success, he wrote to Valentin, *that seeing that the dangers surpassed the advantages that had been hoped for by different processes, he had abandoned all of them, and no longer practised the operation for varices.*

E. Incision. Not wishing to confine himself to the simple ligature, M. Richerand supposed that by incising in a direction parallel to the limb, and to a great extent the tortuous bunches or varicose pelotons, he would be more sure to succeed. I have many times seen him at the hospital of San Louis employ this practice with entire success, and I have myself used it with advantage upon a num-

ber of patients; but the only one upon whom I performed it at the hospital of La Pitié died on the ninth day. We select the part on the limb where there are the greatest number of varices collected together, then with a convex and very sharp bistoury, we cut deeply and to the extent of four, five, six, and even eight inches. After having emptied the veins of the clots by pressure, the wound is filled with lint covered with cerate, and applied either directly or upon a piece of fine perforated linen; the first dressing after this is not made until at the end of three or four days. Then the venous orifices are found closed, and the wound may be dressed flat like any other simple solution of continuity. Bécларd proceeded in the same manner in several cases, and was not less fortunate than M. Richerand. Those long gashes, however, have something frightful in them to the patient, and in reflecting seriously upon them, we cannot see what great utility they can have. In conclusion, we must not confound this method with the simple long incision recommended by Avicenna, (Huguier, *Thèse de Concours*, 1825, p. 12.)

F. The *section*, upon a single point selected, or on different branches when we do not wish to act upon the principal trunk of the vein, would be evidently preferable to the preceding operation. I have performed it fifty-two times at the Hospital of San Antoine and at La Pitié, in the space of six years. One of the patients, it is true, died on the twelfth day, but with ataxic symptoms of a very unusual character, which could only be accounted for from the state of fear or unaccountable morbid apprehension under which he labored before the operation. We met with no traces of phlebitis above the wound, and that which existed below it was found to be wholly disproportionate to the severity of the symptoms. Another died from the effects of a true phlebitis. In three other cases, the phlebitis, after having given occasion to unpleasant symptoms, terminated in abscesses about the wounded vein. The cure was afterwards accomplished without difficulty. M. Warren, who has frequently practised this method, told me that he had always found it to answer well. Nothing is more simple than an operation of this kind; the vein is first raised up in a fold of the skin; a narrow and keen-edged bistoury then passed through the base of this fold, effects the division of it with a single stroke; we thus successively practise the incision upon all the veins that are somewhat considerable in size, and that appear to come from the varicose bunches (*pelotons de varices*.) The blood immediately escapes in large quantity; and we allow it to flow for a greater or less length of time, according to the strength of the patient, after which the wound is filled with small balls (*boulettes*) of lint, before covering it with a plumasseau of the same material spread with cerate, and then with soft compresses; the whole should afterwards be supported with a roller bandage moderately tightened; if we attempted primitive coaptation, the continuity of the vein might be re-established, and thus defeat the object of the operation.

G. M. Brodie, with the view more effectually to guard against phlebitis, (S. Cooper, *Surgical Dictionary*, t. II., p. 594,) confines

himself to dividing the veins transversely by making only a simple puncture in the skin. For that purpose he makes use of a bistoury with a narrow blade and a little concave upon its cutting edge. The point of the instrument is first passed through the integuments upon one of the sides of the vessel; it is then made to glide flatwise between the vein and the dermis; when it has reached the opposite side, its cutting edge is turned backwards, and the wrist at the same time raised in such manner as to divide the venous cord perfectly while withdrawing the bistoury. M. Carmichael and other practitioners have greatly extolled this process; a patient upon whom M. Bougon performed it in my presence, also did remarkably well under it; but Bécclard, who made trial of it at La Pitié, affirms that it gives us no better security against phlebitis and phlegmonous erysipelas than the ordinary incision, and moreover, that it sometimes fails in producing the obliteration of the vein. I agree entirely in opinion with Bécclard, and can add, that without securing us against any danger, this process is the most difficult and the least certain of all.

H. *Exsection* (resection) which had already been practised from the time of Celsus, Paul of Egina, Avicenna and Albucasis, has found some partisans among surgeons of the present day. The two ends of the vein, by retracting under the lips of the wound, cease to be exposed to the influence of the external air, an action which, according to M. Brodie, is a powerful cause of phlebitis. This last argument is entirely hypothetical, and not deserving of the importance that a surgeon of Paris (*Rév. Méd.*, 1836, t. I., p. 29,) has given to it while claiming it as his own property. To say that if an inch of each end of the vein under the skin is not removed, the air may bring on a phlebitis capable of causing death in *twenty-four hours*, is an absurdity which I have no need of making any remark upon.

I. *Appreciation*.—In conclusion, the avowed and unquestionable purpose of the operator is to obliterate the veins that have become varicose; but it cannot be denied that the ligature, without or with the section, or whether that section be transverse or longitudinal, open or under the skin, and that extirpation itself as well as cauterization with potash or the red-hot iron, may all bring about this result, and that this constitutes the whole amount of relief they are capable of affording to the patient. It is desirable, therefore, to know which of all these means is that which produces the least pain, may be performed with the most ease, and exposes to the least danger. The transverse section of the vein, including the skin with it, possesses the different advantages of the other methods, combined with all the simplicity that could be desired.

[Whoever may be the author of the germ of the idea, it is one that undoubtedly belongs to *sub-cutaneous* surgery, though this is obviously one of those cases where the principle or leading feature of this method (occlusion) seems not only not applicable, but injurious, by confining the immense sub-cutaneous extravasation and dangerous infiltration of venous blood that must ensue. T.]

It is finished in an instant; and the youngest pupil can perform it with ease; the pain is almost nothing, and the whole operation differs but little from an ordinary bleeding. What is to be obtained by the ligature so much extolled by Home and Bécclard, except to make the operation considerably longer and more dangerous? Why run the risk, in imitating M. Brodie, of an incomplete division of the vein, and of seeing the blood effused into the sub-cutaneous tissue, and forming there a nucleus and centre for phlegmon or abscess? Is it the division of the skin that should ever disturb us after such an operation? And who does not now know that the action of the air upon the veins is incapable of producing any of those formidable accidents which have been so gratuitously imputed to it? As to the long and deep incisions recommended by M. Richerand, and formerly by J. L. Petit; and to excision according to the method of Celsus, and as Boyer has practised it, they never should be countenanced except for those cases where the varices form painful masses, or have given place, by their degeneration, to tumors that can only be removed by extirpation.

J. But above all other considerations, is it not allowable to have recourse to the mildest of these operations? For has not humanity a right to recoil from the danger of phlegmons, erysipelas, purulent abscesses, phlebitis, and all other accidents which have more than once followed in the train of the operation? Why should we not confine ourselves to a laced stocking or to a roller bandage, which securely supports the parts without making the patient incur any risk? These objections are more specious than solid. It is incorrect to say that varices left to themselves involve no danger. M. Girod, (*Journ. Gén. de Méd.*, t. XIX., p. 65,) in 1824, satisfactorily established this, and Petit (*Mercure de France*, Nov., 1743, p. 2418,) had already shown the danger of rupture of varices. Two patients of whom Lombard (*Plaies Récentes*, &c., 229) speaks, died from the effects of it. Chaussier has related an instance of the rupture of a varicose vein in a pregnant woman, which speedily caused death. Murat has given the case of a washerwoman, in whom death took place from the same accident. In 1827, a statement was made at the Academy of Medicine, of a man in whom it had a similar fatal termination. In 1819, I saw a countryman perish from the loss of blood twenty-four hours after rupturing a varix. The death of Copernicus is attributed to this cause. MM. Reis, Lacroix and Lebrun, (*Nouv. Bibliot. Méd.*, t. II., p. 275,) have each made known a similar fact. A pregnant woman to whom M. Forestier was called, also ran the greatest degree of danger.

Those bandages or gaiters that are recommended to every one, require care and precaution; they incommode more than is generally thought, give rise to excoriations and exudations, (suintements) on different parts of the limb and are not, therefore, so perfectly free of inconvenience. Madame Boivin cites a case of a young woman who could produce a miscarriage at pleasure, by applying a bandage to her varicose legs. Those eczemas too

in fine, and those eruptions (dartres) and ulcerations so difficult of cure, which are almost always produced as soon as the patient takes any exercise, and which inspire terror to the surgeon as well as to the persons who are afflicted with them, can it be said they have never caused death in a single instance, nor never given origin to any dangerous disease, nor made it necessary to amputate the limb?

On the other hand, if it be admitted that after incision of the veins, there sometimes supervene phlegmonous inflammations, and engorgements of various kinds, and that phlebitis also may be produced, it is not the less true that all those accidents are rare, that for the most part they are easily subdued, and that moreover, we may almost always prevent them, if after the simple incision such as I have described it, we take the precaution while inflammation is to be apprehended, to keep the limb enveloped in a compressing bandage from its extremity to its root; the presence in fact, of the varices themselves, endangers the liability to such accidents as much perhaps as the operation does.

§ II.—*New Methods.*

We possess, after all, at the present time, processes more simple than the preceding, to effect the obliteration of superficial veins. The experiments upon the acupuncture and ligature of vessels, which I described in this work in 1830 and 1832, brought about results which have since been adopted in practice. M. Davat and M. Fricke have proved, as I also have done, that a needle or a thread passing through each varix, and left for some days, is sufficient to effect its occlusion. I have myself devised a plan which is yet more simple. In place of perforating the vessel with the needle, I seize it, and raise it up in a fold of the integuments, with two fingers, in order to pass a pin below it, and form a kind of twisted suture, or one of circular construction. The vein is thus strangulated between the body of the pin, which should be strong, and the skin which the thread tends to divide backwards. We may thus place from ten to twenty pins in the same sitting, or at intervals of a few days, upon the principal varicose branches. No dressing is afterwards necessary. If we cut off the points of the pins, or apply a piece of linen or a containing bandage, it is only to prevent the possibility of the patient wounding himself while turning in bed. I remove the pins on the sixth, eighth, or even twelfth day, according as the vein appears more or less completely obliterated. The puncture closes soon, and in a few days after, the patient may recommence walking. When the portion of the skin included between the pin and the thread forms an eschar, we must wait for its separation, and treat the wound afterwards as for a burn of the fourth degree.

Nevertheless, we must not count on the efficacy of these operations, which can be performed only upon patients whose deep-seated veins have preserved their natural condition, and where the

patients themselves desire the operation, and that the varices have produced effects that are calculated to interfere with the functions of the diseased part, or to compromise the general health. The cure at best, is rarely complete. The anastomoses soon reproduce the varices, and at most, prudence suggests that we should confine ourselves to the obliteration of the branches which are in the neighborhood of the ulcer or the eruption which alone have caused the patient to ask for relief. I have already performed on one hundred and fifty persons the operation which I have described; and up to the present time, no accident of a grave nature has occurred. A very small circumscribed phlegmon is the most serious one I have noticed. More circumstantial details, however, will be given upon this subject in the following article.

ARTICLE II.—VARICES IN PARTICULAR.

Although varices of the lower limbs have almost exclusively attracted attention, all the other regions of the body are not less liable to be affected with this kind of disease. Wedel, (*Collection Académique*; partie étrangère, t. VII., p. 450,) speaks of varices of the upper extremities which gave place to dangerous hemorrhages by their spontaneous rupture. I have twice seen the arms, fore-arms and hands covered with varicose enlargements (bosselures.) A young man admitted into the hospital of La Charité in 1838, had from his infancy a varicose tumor (un peloton de varices) as large as the fist, between the angle of the jaw and clavicle on the right side of the neck. M. Champion informs me that he has seen a young lady who had a varix of the size of a small egg, under the tongue. I have met with a young person who had one of the size of the thumb under the superciliary ridge. I have in fact seen one in a man of about thirty years of age, situated upon the course of the sagittal suture, and which appeared to be connected with the longitudinal sinus in the falx of the brain. Baillie, Alibert and M. Huguier (*Thèse de Concours*, p. 19) have given instances of them upon the cranium or jugular vein. Varicosities upon the nose, eyelids, and the entire face are far from being unusual. The chest also is frequently the seat of them. But the hypogastrium, the external genital organs, and the lower extremities are nevertheless their favorite localities.

If it is true that in the hypogastric region the sub-cutaneous or deep-seated veins may acquire a volume so considerable, and intertwine (enlacer) and fold themselves in such manner as to resemble numerous leeches gorged with blood, as I have seen in three instances, it is also true that such varices scarcely ever create any solicitude either in the patient or the surgeon. In treating of hernia I shall speak of the danger which results from such varices when they spread in the neighborhood of the groin, or are prolonged in the form of cylinders or tumors as high up as the umbilicus.

We find in Theden (*Neue Bemerkungen*, etc., t. II., chap. 5, p. 75) an instance of aneurismal dilatation of the veins of the belly,

which appeared to have no influence upon the health of the patient. Thédén also speaks of a vena cava whose dilatation might have given rise to the belief of a hernia of the heart. If operations are not practised upon the veins of which I have been speaking, it is not because the obliteration of these vessels, however enlarged they may be, are in reality dangerous. I have elsewhere given an instance of a vena cava descendens (supérieure) obliterated by a tumor at the apex of the chest. Dance (*Nouv. Bibliot. Méd.*, 1828, t. I., p. 451) speaks of a similar obliteration, which was accompanied by that of the subclavian veins and the azygos, without there having been any œdema or infiltration above. In the patient mentioned by Wilson, (*Expér.*, t. II., p. 336,) this obliteration had caused only a slight œdema in the face.

The external iliac veins were obliterated in a patient who had never been attacked with dropsy, which case has been published by M. Manec (*Nouv. Bibliot. Méd.*, 1827-28, t. I., p. 451.) Descot (*Affect. Loc. des Nerfs*, p. 124) mentions a case of the same kind from Béclard. We are indebted for another to Baillie (*Anat. Pathol.*, p. 20-22). In the case of M. H. Bérard (*Thèse* No. 23, Paris, 1826) it was the vena cava ascendens (inférieure) which was closed; so that there is scarcely perhaps a vein in the animal economy whose obliteration, and that without endangering life, has not been noticed. In some regions, where they are found externally, the varices might in truth be reached by the operations which have been described above; but in reality we occupy ourselves only with those of the legs and the external genital organs. It follows, therefore, that in treating of particular kinds of varices I shall confine myself to those of the abdominal extremities and the scrotum.

§ I.—*Varices of the Lower Limbs.*

All that I have said of varices in general, applies particularly to those of the pelvic extremities; I have only now therefore to point out what there may be of a special nature in the manipulation of the operation on these organs.

[Before which we take occasion to speak in this place of two extraordinary cases of varicose enlargement, or hypertrophy of the veins of the lower extremities, which have been observed in this country, and which are both now living, one an adult of about 60 as observed by Dr. Mott, the other a young man of about 21 which recently occurred in my own practice. There are perhaps not on record two more remarkable cases. Dr. Mott states that in his patient, who is a person of unusually tall and erect stature, and of stout frame and otherwise perfect health, but from habit and his profession much accustomed to walk or to be in the erect position, the entire mass of venous trunks and anastomoses in the sub-cutaneous tissues are so enormously distended, that they seem to constitute in each leg from the toes to the hips one general diffused encasement of venous blood and aneurismal dilatation. Were it

not for firm containing bandages in which both limbs are kept constantly enveloped throughout their whole extent, death would inevitably ensue from the continual danger of exhausting hemorrhage by the spontaneous rupture which the gravitation of the blood above would doubtless cause. When the bandages are momentarily removed, the veins fill up to such degree as to enlarge each leg and thigh almost to the dimensions of the body of an ordinary sized man. When the bandages are on, the power of walking slowly, though even that is much impeded, is not destroyed. This patient is of a highly sanguineous temperament and of very florid fair skin, though very temperate and regular in his habits, and tall, robust, remarkably straight and well made in his frame, and of unusually symmetrical proportions, though near 6 feet 6 inches high.

In the case of the youth, in my own practice, and who on the other hand is of unusually pale complexion and of delicate make and dark hair and eyes, indicative of that order of scrofulous temperaments, the disease is congenital, similar in some respects to the remarkable case only described by Breschet, but infinitely more extraordinary. The superficial veins of one leg only appear to be affected. The dorsum of the foot and the entire outer part of the lower leg are covered with their convolutions so thickly and to such extent as to resemble large worms intertwined in every possible tortuous and serpentine shape—making a perfect net-work. But about the ankles they form large reservoirs of several inches in length and near three-quarters of an inch in calibre. One of these also crosses the patella obliquely, where it may be seen and felt through woollen pantaloons, as large as the thumb and *slightly pulsatory*. It then proceeds obliquely upwards and backwards upon the outer part of the thigh. Here on the outer part of the thigh it forms a tortuous reservoir of *near an inch in diameter*. When lying down they all nearly disappear for the moment. The disease seems hereditary. The general health is unaffected. T.]

A. *Ancient Processes*.—I. *Compression*.—When varices of the legs are treated by compression we generally envelop the whole of the limb in a roller bandage or a laced stocking, in order that the entire mass of veins may be supported in a uniform manner. M. Colles, however, a distinguished surgeon of Dublin, informs me that he has limited himself to making strong compression upon the internal saphena vein in the fold of the groin by a kind of circular pelote, and that he has by this means effected cures. This method appears to me so contrary to what we know of the progress of varices, that up to the present time I have not ventured to make trial of it. As however I have particularly remarked, that the garters, though tied somewhat tight, did not always increase the size of the varices, and that compression made at the lower part of the leg only occasionally causes temporary engorgement of the veins of the foot, and as M. Colles is a gentleman entitled to confidence, I shall take an opportunity to make trial of his method upon some cases that may offer.

II. *Excision*, (l'excision,) *exsection* (la résection) and *incisions*

by the method of the ancients, or J. L. Petit, could be practised upon the legs as well as in any other region. The same remark applies to the ligature and exsection. Vesicatories employed, it is said, (*Chir. des Hôpitaux*, t. II., p. 392. Huguier, *Thèse de Conc.*), in St. George's Hospital, London, would require no special directions in these cases.

III. *Transverse section*.—In order to divide the veins of the lower limb by the most simple process, it would be necessary that the leg and thigh should be in a state of relaxation. The surgeon then seizes the vein in a fold of the skin above its swollen portions; holding this fold by one of its extremities with the thumb and forefinger of one hand, while an assistant raises the other extremity in the same manner, it is divided transversely by inserting the point of a straight bistoury near its base and under the vein, and in such manner that the back of the instrument should be turned towards the limb. Performed in this way, the operation is prompt and but little painful. To arrest the bleeding a considerable degree of pressure is required upon the lower end of the cut vein. Balls of lint should be applied directly, or upon linen spread with cerate at the bottom of the wound; without that the continuity of the vein might be re-established and the object of the operation defeated.

There are no points upon the leg where this section cannot be performed. If the varices belong to the system of the external saphena, we are to look for the trunk of this last in the neighborhood of the ham. It is well to remark (Huguier, *Thèse*, p. 35) upon this subject that the *external saphena* is often composed of two principal branches: one, ascending, which belongs to the leg; the other, descending, which comes to it from the posterior region of the thigh, which branches unite to form a common trunk in the popliteal space (*creux*.)

When, on the contrary, the varices depend upon the *internal saphena*, it is below the knee and opposite to the *pes anserinus* and above the inner condyle of the femur that its section is to be made. For greater security, also, it would be advisable to divide each dilated vessel upon different portions of the leg. Without that there would be reason to fear that the innumerable anastomoses of the veins of the whole limb would ultimately reproduce the varices.

B. *New Processes*.—All the new processes applied to varices of the legs may be referred to acupuncture, the ligature, or local compression.

I. *Acupuncture*.—The researches which I made in 1829, (Read to the Institute, the 27th of December, 1830,) having proved that it required only to keep a foreign body lying transversely through a vessel for some days to effect its obliteration, it was very natural that acupuncture should be soon applied to the treatment of varices. This method which M. Fricke and M. Grossheim (*Jour. des Conn. Méd.-Chir.*, t. II., p. 221, 1834) were the first to put in practice upon the living human subject, in cases of varicocele, is divided at the present time into two processes, that of M. Fricke and that of M. Davat.

a. Process of M. Fricke.—M. Fricke has not confined himself to pure and simple puncture; if he perforates the vein with a needle it is in order to insert into it a thread in the manner of a seton. For that purpose the vessel is grasped in a fold of the integuments, as if it were with the view of performing the transverse section, or we hold it firm by placing the fore-finger and thumb upon its sides. Then with a needle armed with a simple thread we transfix it from one side to the other. In order to be more sure of obtaining inflammation we may pass in this manner two or three setons through the same vein at intervals of a few inches. The operation is repeated in this manner on each of the venous trunks that we wish to obliterate. If we attack the trunk of the saphena vein at two different points below the knee, and at two other points on the thigh, it will generally be rendered unnecessary to transfix the other veins of the leg, unless the system of the external saphena should also be implicated.

Each seton should then be tied separately and moved in the vein morning and evening until inflammation has supervened. We are generally enabled to remove them from the second to the fourth day. A deposit of plastic lymph is now effused in the neighborhood, the walls of the vein inflame, and it soon becomes impossible for the blood to flow there. If the inflammation is developed too rapidly, or becomes too intense, we first remove the threads and then reduce it by the ordinary means, but only in moderation so long as it continues to be local.

M. Fricke has written to me (13th of November, 1835) that the treatment of varices by threads or setons has always succeeded with him, and that in his hands it has never caused serious accidents. I have myself made trial of it on twelve patients: the veins became inflamed in all. Eight of them had local symptoms only, and left the hospital apparently cured; three others were seized with inflammation which extended along the veins from the foot to the upper part of the thigh, and which taking on the character of a phlegmonous erysipelas, terminated in large purulent collections: numerous incisions in the leg, ham and thigh became necessary, and these cases caused me much alarm. I will add that one of them came back to me eighteen months afterwards, and that his varices had re-appeared. Moreover the internal saphena which had been perforated by the threads was itself again dilated. The twelfth was still more unfortunate; he was a butcher's boy of extreme timidity, but also in excellent health. Symptoms of internal and external phlebitis, and angioleucitis soon supervened, ending in death at the expiration of eight or ten days.

Since this accident I have no longer indulged the thought of repeating the essays of M. Fricke who, however, in his letter, spoke only of varicocoele. Two reasons combine to induce us to reject this process: 1. It is impossible that the inflammation which is thus designedly created should not sometimes become diffused and purulent; and then all the dangers of internal phlebitis and purulent infection present themselves before the eyes of the practitioner;

2, on the supposition that the operation occasions no serious accident, and that it effects the obliteration of the vein, it is next to certain that the circulation will frequently ultimately re-establish itself in the vessel and defeat the result of the operation. It is a process, in fact, which has nothing to recommend it but the promptitude and facility of its manipulation.

b. Process of M. Davat.—M. Davat, from researches of which he published a summary in 1833 and 1834, (*Thèse* No. 93, Paris, 1833.—*Arch. Gén. de Méd.*, 2e sér., t. II., p. 5,) was led to the conclusion that to cure varices with certainty, it was necessary to adopt the following mode:—A pin is first passed under the vein and through the skin from one side to the other. Raising up the vein by embracing this pin by its two extremities, the surgeon, provided with a second needle, transfixes the vessel itself, from the skin towards the *deep-seated* parts, penetrating thus underneath the first pin, in order to pierce again through the same vein from the deep-seated parts towards the skin, in such manner that the two metallic stems cross each other at right angles. A thread then passed under their extremities serves to retain the whole in its place. This process, which was not put in practice on the living subject until after 1835, and which M. Norris, (*Philadelphia Med. Examiner*, April 1838, Exp., t. II., p. 112,) says he has made trial of with success in America, is invariably successful, according to the author, and never produces serious accidents. In the memoir of M. Davat, however, there are facts which disclose the danger of this method, and in the case of a man upon whom it was performed at the Hotel Dieu, in 1837, death was the consequence, (Landouzi, *Journ. des Connaiss. Méd.-Chir.*, 1838, p. 97.) We cannot indeed understand how a pin left through a vein, would not produce phlebitis as soon as the presence of a thread, and every one knows that phlebitis is the principal danger in all the operations performed for varices.

If this process, however, is a little more difficult and embarrassing than that of M. Fricke, it ought also to be more certain in its result. The two pins, crossed, necessarily cause the ligature which passes under them to give a curve to the vein and to have a tendency to interrupt its continuity. There is, therefore, less chance of relapse by this method than with a simple seton.

II. *Compression.*—*Process of M. Sanson.*—Taking his idea from a process used for varicocele, and of which I will speak further on, M. Sanson (Brioux, *Thèse* No. 282, Paris, 1836,) has proposed a sort of *clasp* or forceps, by means of which he has attempted to obliterate the varicose veins of the legs. This forceps which the author (Boinet, *Gaz. Méd. de Paris*, 1836, p. 84,) appears to have often used with success, is not to bear on the vein itself. To apply it, we endeavor to draw the vein into a fold of the integuments and place the bite of the instrument immediately below it. It results from this, that the vein is compressed by the skin which permits itself to be drawn and pulled backwards by the pressure of the for-

ceps. What I have said of the return of the disease, after the use of the seton or pin, sufficiently shows that this kind of compression, though simple and attended with but little danger, cannot have much efficacy. For which reason I have not thought it necessary to make trial of it.

b. Process of the Author. The ligature upon varicose veins is, as I have said, one of the most ancient methods. But if we adopt what Paul of Egina, and those who have described it formerly, say of it, we ought first to incise the teguments in order to lay bare or isolate the vessel. In this manner, the operation is as painful and as serious, as by the different processes of excision or incision. At the present time, we have in use other kinds of ligature.

Having devised my process in 1830, I first tried it upon animals, and confined myself in the first edition of this treatise to make only casual mention of it. I employed it for the first time in 1833, at the hospital of La Pitié for varices of the legs; since that time I have performed it on more than a hundred patients. M. Franc, (*Thèse de Montpellier*, Mars, 1835,) who on his part thought that he was the author of it, also extols its simplicity.

1. *First Stage.* This process is performed with a pin for each vessel. It is advisable that this pin should be strong though well sharpened, and with a large but smooth head. A strong and well-waxed thread is also necessary. After having seized and raised up the varicose vein in a fold of the skin, we cause an assistant to hold one of the extremities of this fold, while we stretch the other ourselves.

2. *Second Stage.* The parts being thus arranged, and the vein completely pushed above the fingers, which should try to touch behind it, the surgeon transfixes the whole cutaneous fold with the pin, in passing it under the nails of his two fingers. The vein is then situated astride the pin, which it crosses at a right angle, without having entered its interior. We thus proceed upon two or three points of the saphena above the knee, and upon all the veins which are found dilated along the leg or on the foot. It may be necessary to use eight, ten, or even fifteen pins, successively on the same limb, though the insertion of two or three is often found quite sufficient.

3. *Third Stage.* In order to complete the operation, a noose of thread must be passed upon each of the pins, in order to strangulate upon them as firmly as possible the veins to be obliterated. At first, I crossed this thread in the manner of a twisted suture, as in hare-lip; but having found how difficult it was to obliterate the vein, so as to prevent a return, I thought it advisable to adopt another mode. At the present time, then, and since the year 1837, I place the ligature circularly under the extremities of the pin, which an assistant is charged with raising up, while I strangulate the tissues forcibly behind it. I thus obtain three constrictions which bear on three points of the vein, one which the pin effects from behind forwards, and the two others which are produced by the superior and inferior border of the circle represented by the thread, and which act from the skin towards the deep-seated tissues. For greater cer-

tainty still, I wait until the constriction has mortified its way through the small packet of tissues included in the thread; which happens in the space of from six to twelve or fifteen days. If, about this period, the eschar does not come away of itself, I remove the pin and also the ligature, being well assured that at that time the vein is certain to have closed.

4. *Fourth Stage.* It is not the insertion of the pins which is painful in this operation; but it is the application of the ligature which seems to produce in some patients an acute degree of suffering. Nothing can be more simple than the phenomena which follow; often they are limited to the mere mortification of the peloton of strangulated integuments, and unaccompanied with any marked inflammation. Livid-colored phlyctenæ supervene, and the skin takes on a darkish or muddy tint. An inflamed line which afterwards becomes purulent and ulcerated forms under the ligature. The eschar is then isolated and separates as in a burn or contusion, and leaves exposed a sanious wound, which is cleansed and cicatrized afterwards in the manner of ulcers or ordinary wounds. Often also a red, painful kernel, (noyau) having the appearance of phlegmon, is developed about each pin, at the same time that the strangulated vein becomes swollen and hardened and is transformed into a solid cord above and below. It sometimes happens that the inflammation proceeds on to suppuration, and gives rise to true abscesses.

5. *Fifth Stage.* The pins having been once placed, the operation requires no dressing, and so long as there is no acute inflammation we may allow the patient to get up and take some exercise. At a later period it may be required to use leeches or topical applications, emollients, or resolvents; and so also when the pins are removed, each region that they occupied must be treated as a small abscess or burn. It is unnecessary to add that immediately after the operation the point of each pin should be snipped off by means of a cutting nippers, or a pair of stout scissors, and that to prevent our wounding the fingers in applying them, it is advisable to make use of a thimble or a piece of thick linen. These precautions would be unnecessary, if we had pins with the heads well rounded, and of a metallic quality sufficiently solid to allow of their being well-sharpened and reduced to a small size. (See on this subject: Houel, *Bulletin de Thérapeut.*, t. XIII., p. 145; Dupresse, *Journ. Hebdomad.*, 1836, t. I., p. 257; *Bulletin de Thérapeut.*, t. II., p. 59-62, t. XIII., p. 108, Septembre, 1837; *Journ. des Conn. Med.-Chir.*, t. III., p. 20; also May or June, by M. Helot; *France Med.*, t. —, p. 56; Brioux, *Thèse No. 282*, Paris, 1836.)

6. Whenever the veins are rolling and moveable under the skin, the operation which I have described presents no difficulty; but it not unfrequently happens that we find them too closely adherent against the inner side of the tibia, the dorsum of the foot, and the neighborhood of the malleoli, to allow of our raising them in a fold of the skin. In that case, we must insert the pin almost perpendicularly upon one of the sides of the vein, then incline it so as to

slip its point underneath, and make it come out from within outwards, upon the other side. The pin in such case should possess considerable strength; otherwise, we should soon find its two extremities bend or raise up under the pressure of the ligature, especially when using the circular constriction in preference to the twisted suture.

7. A precaution also to be attended to, in all the processes to be employed for the cure of varices, is that which relates to the position in which the patient should be placed at the time of the operation. In order that the veins may attain their full size and be rendered prominent, it is advisable that the limb should be held in a pendant position. If the teguments are pliant, and the sub-cutaneous tissue but sparingly supplied with fat, this position will not interfere with our obtaining a grasp upon the veins, or in any way incommode us in the application of the pins. In individuals, however, who are fat, and in whom the skin is tense, the case is very different. The veins in such persons lie close against the aponeurosis and the bone, and it may be impossible to grasp them in a fold of the integuments. In such cases, we select with care the points where the pins are to be placed, while the patient is in the vertical position. We then place him in a recumbent posture, and while the limb is in a state of semi-flexion, pinch up, between the thumb and fore-finger, the vein, which is recognizable under the skin by its form, resembling that of a cord, as if it were a woody substance. I should remark, moreover, that it is best to begin by strangling the vein around the upper pin, as the nervous filaments, which might possibly be included in this upper ligature, would render the pain of the others less acute.

8. The application of a ligature to the veins, by entwining it around a pin, is an exceedingly simple operation—one that produces no more pain than any of the others, that all patients bear without any inquietude, and one which any person has it in his power to perform. As it is one also which mortifies and destroys a portion of the vein, it ought to be as effectual and complete as any of those that have been made trial of up to the present time. The object of all surgeons, in this matter, is to obliterate the vein operated upon; but the process of the pin accomplishes this result with as much certainty as excision, and in a more perfect manner than acupuncture or local compression. With respect to dangers, I have as yet made trial of no method which is attended with fewer than this. Out of more than one hundred patients, upon whom I have employed it, not one has died. I may add, also, that not one of them was exposed to any real danger. The worst that did happen, was an external phlebitis and a phlegmonous kernel.

The only objections that might be made to it, are, that of incurring the risk of passing the pin between the integuments and the vein, and thus completely frustrating the object in view; also that of allowing in some cases the vein, at a later period, to reacquire its permeability, where the strangulation has not been applied at a sufficient distance. But these inconveniences belong, in a still greater

degree, to acupuncture by the process of M. Fricke, and also to the method of M. Davat. The different modes of incision, also, are not free from these objections.

c. *Process of M. Reynaud.*—A surgeon of Toulon, M. Reynaud, (*Gaz. Méd.*, 1837,) after modifying the process by the ligature which I have described above, adopted, in some of his cases, the following method: Passing a needle, with a thread properly waxed, under the vein and through the skin, he proceeds to tie the two ends, and to fasten them by a bow-knot upon a roll of diachylon plaster, or a small graduated compress. This appears to be the indirect (mediate) ligature which Chaumète (*Exchirid. de Chir.*, p. 278) and Lombard, (*Plaies Récentes*, etc., p. 249,) employed, and of which these authors had already given an imperfect description. As the thread may be untied at pleasure, it allows of being again tightened every day or other day until the vein is divided. There is no doubt that we may succeed by operating in this manner; but the obliteration of the veins by this mode of division is so difficult, that there is always danger of their continuity and circulation being re-established. The process by the pins, which is at least as simple and as easy, and which also allows of increasing the constriction at pleasure, appears to me to be still preferable.

C. I must not, however, terminate this article, without adding, that such processes are still too new to enable us to judge of their comparative value, with a full knowledge of the causes.

On the other hand, practitioners should bear in mind that varices of the legs are far from always yielding to these modes of cure. Thus, though one of the dilated veins may be obliterated, three or four others will soon reappear. Owing to the branches of the external saphena communicating with those of the internal saphena, and the superficial veins anastomosing with those that are deep seated, the venous system of the abdominal extremity represents a vast net-work, whose circulation it is next to impossible to interrupt, and which, whatever we may do, will always render the complete success of these various operations exceedingly problematical.

[VARICOSE VEINS.—The *mediate or indirect application of the ligature to varicose veins*, the saphena and spermatic for example, as lately much commended by Dr. Pagani, (*Gazetta Medica de Milano*, November, 1844; see also Cormack's *Lond. & Edinb. Month. Journ. of Med. Sc.*, Feb., 1845, p. 140,) and which consists, after passing the ligature by a curved needle under the raised vein and fold of the skin as above described, in tying the knot on a small rouleau of linen, placed on the skin, is a very ancient practice revived, so far as relates to this indirect pressure on an artery, (See this present vol., also vol. I.) In varicose veins, the pressure thus sought for externally is equally well, if not more completely and effectually obtained by the sub-cutaneous, and, as it may be called, the *sub-venous* methods, combined, as practised by M. Velpeau. Through means of the direct linear pressure, sub-cutaneously exercised by the pin from within and outwards, and the correspond-

ing pressure from the circular threads externally, embracing the head of the pin, our purpose of the gradual division and cicatrization of the vein is much better fulfilled.

Varicose Veins in the Pudenda.—Death by Hemorrhage.—The pudenda themselves are not free from a varicose enlargement of their veins, which in one case, related by Dr. Hesse, (*Medicinische Zeitung von Preuss.*, Verein No. 48, Nov. 30, 1842; also, Cormack's Journal, Feb. 1843, p. 158–159,) proved fatal by sudden and excessive hemorrhage, near the termination of a fifteenth pregnancy. The Cesarean operation was performed a few moments after the death of the mother, but the child was also dead. The uterus appeared to be ensanguined, and in the left labium, which was large and flabby, there was an opening of about half an inch in length, from which black tar-like blood was readily expressed. This opening led to numerous venous canals, both laterally and inwards, deep into the perinæum. The husband informed Dr. Hesse that his wife had long labored under a great enlargement or swelling of the left labium, which, as it appears, was nothing more than an enormous varix. T.]

§ II.—*Varicocele.*

The word *varicocele*, employed, like that of *kirsocele* or *cirsocele*, to designate the dilatation of the veins of the scrotum, though applicable to every tumor formed by veins, is, however, exclusively confined, at the present time, to the dilatation of the veins of the spermatic cord. *Varicocele*, though a very common disease, and noticed principally between the age of fifteen and that of forty, that is, during that period of life when the genital organs possess all their activity, is almost always confined to the left side. It is rare, however, that serious consequences result from it. The swelling, inflammation, suppuration, and atrophy of the testicle, which some authors have attributed to it, do not happen in one in a hundred, perhaps in not one in a thousand cases; and I can scarcely comprehend how modern surgeons should have so far misconceived this subject, as to consider a disease dangerous which, in 99 cases out of 100, constitutes but a slight infirmity. The usual inconveniences are only a slight uneasiness, a drawing-down pain in the loins and in the groin or scrotum, together with a slight numbness of the testicle. To which I may add, that an immense majority of persons who are affected with it, may have it all their lives without being aware of it.

These preliminaries being established, we shall be enabled to understand to what extent *varicocele* may be subjected to surgical operations.

A. *Ancient Methods.*—All the old processes which I have pointed out under the article of *varices* in general were applied formerly to *varicocele* itself. Cauterization with slender-pointed rods of iron, and with chemical caustics were made use of at the time of Celsus, (*De Re Med.*, lib. VII., cap. 32.) The ligature, excision, incision,

and extirpation, which also had their partisans, are likewise mentioned by Celsus. Paré (Liv. VIII., chap. 18) proposes that after having passed a double ligature underneath, we should fix one of the threads at the upper and the other at the lower part of the varix, in order to incise the veins between the two ligatures, and afterwards to dress the entire wound as in the case of an ordinary varix. Paré (Liv. XIII., chap. 30) expresses himself to the same effect about varices of the legs. Cumano (Mouton, *Dict. des Scien.-Med.*, t. V., p. 261) had recourse to extirpation as well as ligature upon the varicocele. After having made a long incision through the integuments and penetrated to the cord, this surgeon isolated the tumor which he tied above and below before excising a large portion of the scrotum. The upper ligature came away on the twentieth, and the lower on the thirty-fifth day; but the wound was not completely cicatrized before the fiftieth day.

I. Like Celsus and Paul of Egina, Delpéch, (*Lancette Francaise*, t. III., p. 24,) laid open the scrotum, exposed the cord, isolated it, and tied or incised its veins. By this method he cured, it is said, six cases out of seven; but abscesses and sometimes death were the consequence. It is also known that Delpéch, (Gaspard, *Thèses de Montpellier*, 1832,) who sometimes confined himself to introducing and securing a piece of sponge under the dilated veins with strips of adhesive plaster, was assassinated by a patient upon whom he had thus operated.

II. M. Warren writes to me that he has often excised or tied varicocele with success, and M. Moulinié (*Bulletin Med. de Bordeaux*, 1833, p. 57,) who has no apprehension of incising the tissues even from the inguinal ring to the lower part of the scrotum in order to tie the dilated veins of the cord, and to divide them above, maintains, as does also M. Rima, (*Gaz. Méd.*, 1737, p. 234,) that this mode is still preferable to all others. In fact it seems very clear to me, that the accidents which have been imputed to all these methods have been singularly exaggerated; that inflammation and abscesses of the scrotum are, with some rare exceptions, all the results that they can in any case produce. If, therefore, Dionis, and in our own time, Boyer, (*Malad. Chir.*, t. X., p. 233,) and all discreet surgeons have rejected them, it is less on account of their real danger, than because of their insufficiency, or the benign character of the disease.

III. As to the proposition to lay *bare the cord*, in order to tie the spermatic artery, which M. Bell approves of, and some surgeons (Arch. Gén. de Méd., t. XIX., p. 461, 462, 614,) have practised, which M. Maunoir has performed for sarcocele or to excise a portion of the vas deferens, as has also been done by MM. Morgan, (*The Lancet*, 1828, Vol. I., p. 251,) Lambert and Key, (*Ibid.*, Vol. II., p. 476;) it is an operation the propriety of which we have no need of discussing at present while treating of varicocele.

IV. *Castration*, which is an operation that Celsus reserved for cases where the testicle itself was the seat of varices, and which

Boyer (*Malad. Chir.*, t. X., p. 234) also sanctions where varicocele becomes in reality a serious disease, cannot in the present day be indicated in any presumable case, except that of complication.

V. In fact, if surgery were to confine itself to the ancient processes, it were better to abandon varicocele to itself, and to moderate its development and inconveniences by means of topical astringents and good suspensories. The exceedingly rare cases in which it manifestly has a tendency to produce disorganization in the testicle, would be the only ones which would justify the conscientious surgeon in having recourse to such operations.

B. *New Processes.* In devising the new processes of which I have already previously spoken, surgeons at the present time had varicocele chiefly in view. These processes, now six in number, are those of MM. Davat, Fricke, Breschet, Sanson, and Reynaud, and that of my own. Based upon my researches, on the acupuncture of veins, they have come into practice in the following order:—

My experiments made in 1829, were published in 1830, (*Gaz. Méd. de Paris, Janv.*, 1831; *Lancette Française, Janvier*, 1831; *Journ. Hebd. Univ.*, t. I. et II.) M. Davat made his known in 1833, (*Thèse citée*, 1833,) and it appears to have been in the beginning of the year 1834 that M. Fricke introduced his mode into practice. M. Breschet (*Gaz. Méd. de Paris*, 1834, p. 33,) communicated his to the Academy of Sciences in January, 1834. Mine had already been applied to the human subject about the close of the year 1833. It was not until 1835 or 1836 that M. Sanson (Boinet, *Gaz. Méd.*, loc. cit.,) proposed his forceps. Finally, in the year 1837, we have the process of M. Reynaud, (*Gaz. Méd. de Paris*, December, 1837.) These processes, though originating from a common source, differ so much from each other, that there is no necessity of discussing their priority.

I. *Process of M. Fricke.*—In order to perform the operation proposed by M. Fricke, the patient is placed on his back, unless it should be advisable that he should be kept in the erect posture or upon his knees for the purpose of increasing the dilatation of the veins. The surgeon then proceeds immediately to search for the principal varices of the cord. Having seized them with the thumb and forefinger of the left hand, he inserts through them an ordinary needle, or as M. Fricke advises, a needle made expressly for this purpose, and armed with a single thread. If the vein is long we pass the needle through it a second time an inch higher up or lower down, and we do the same with each of the other veins whose size appears to be enlarged. The threads remain there in the form of setons for one, two or three days. We then remove them in order to prevent too active an inflammation. During the time the patient remains in bed the scrotum is supported upon a small cushion and kept covered with resolvent or emollient applications, according as the inflammation should appear to be more or less active.

This process, which M. Fricke had already employed successfully upon 38 patients when he wrote me in 1835, appears to be

liable to a number of objections. In inflaming the interior of the veins which penetrate directly into the abdomen, it incurs the risk of producing a phlebitis which it might not be possible to control and which might speedily prove mortal. Moreover varicocele is never constituted of a single vein, and the tissues of the scrotum are too moveable and too supple to enable us to be perfectly assured when we have placed setons in the veins, that we have perforated all of them and that none have escaped. In fact the circulation might evidently be re-established in some of the veins themselves that have actually been transfixed, and thus allow the varicocele to be reproduced.

So also the needle may miss the veins we wish to hit, the permeability of those it has traversed may be afterwards re-established, and if phlebitis should supervene it is of course exceedingly dangerous. This then is a process which should be rejected.

II. *Process of M. Davat.*—M. Davat, like the surgeon of Hamburg, first seizes the veins of the cord with the forefinger and thumb of the left hand. He then inserts under them a first pin transversely, then a second through the vein in such manner as to make it pass under the first pin before its point emerges on the opposite side, so that we form in this manner a cross, one of whose branches twice transfixes the vessel. If some of the veins at first have escaped they are treated in the same manner. Nothing remains but to introduce a sort of ligature under the pins so as to strangulate the vessels. It does not, however, appear that M. Davat has yet applied his process to the treatment of varicocele. He has hitherto employed it only for the veins of the leg; but it is liable to the same objections as that of M. Fricke. Nor should we have more certainty of transfixing all the varicose veins of the cord with the pin than with a needle or seton, and it is evident that one of these bodies exposes as much to internal phlebitis as the other. The only advantage in the process of M. Davat might be in thus associating a sort of external constriction with acupuncture, the possible chance of strangulating the veins which have not been pierced, and perhaps, also, of thereby restraining the progress of the phlebitis. It is, however, singular that M. Davat who had used my process alone in the year 1831, as the first stage of his own, (*Petit, Journal de Med. et de Chir. Prat., &c., 1831,*) has since persisted in rejecting it as insufficient. (*Thèse citée, p. 24.*)

III. *Process of M. Breschet.* M. Breschet employs neither setons nor pins (*Gaz. Méd., 1834, p. 33*) for the cure of varicocele. The method of this surgeon consists in strangulating all the dilated veins together with the envelopes of the scrotum, by the branches of a species of forceps. This forceps designed after the manner of that which Dupuytren contrived to remove the salient angle (eperon) of the intestine in artificial anus, has undergone a modification by M. Landouzy, (*Jour. des Conn. Médico-Chir., Mars, 1838,*) which renders it at the present day exceedingly simple. To apply it we commence by isolating the veins in the cord as completely as possible from the vas deferens and spermatic artery. Placing the

extremity of the branches (*des plaques*) of the instrument between these two orders of bodies, we immediately approximate them together by means of a screw or ring so as to compress and embrace the varicose bundle only. The whole is thus left in place and the patient kept at rest. The compression is afterwards increased each day, until it is no longer possible for vitality to be maintained in the portion of tissues which has been strangulated. The forceps is not to be removed except with the eschar. The loss of substance which results from this, and which in the first process of M. Breschet sometimes exceeded two inches in length, leaves a wound which gradually diminishes and cicatrizes after the lapse of six weeks or two months.

With any kind of forceps whatever applied upon these principles we necessarily interrupt the continuity of the veins, and as they are all strangulated, we have thereby a fair prospect of effecting a radical cure of the varicocele. M. Landouzy (*Journ. des Conn. Médico-Chir.*, 1838, p. 88) avers that more than 100 patients have been cured in this manner. The forceps of M. Breschet however is annoying to the patient; an eschar so extensive endangers erysipelas, phlegmon, and abscesses in the scrotum, while there results from it an enormous ulcer of great length and difficult to heal. Nor can we perceive why phlebitis might not occasionally be produced by it, or why the testicle and the generative function have less to apprehend from this operative method than from the others. It is certain that some of the patients who have submitted to it and have come to consult me, make great complaints against it. Moreover this process with all its apparent simplicity has much analogy in fact to that of Cumano; and if it is to be regarded as one of the most efficacious, there is room at least to hope that we may discover others that are more simple.

IV. Process of M. Sanson.—Being desirous, above all things, of avoiding the danger of phlebitis, M. Sanson proposes to obliterate the vein by the concretion of the blood, much rather than by an actual inflammation. The forceps he uses is so constructed that the extremity of its points exercises a compression stronger than the rest of its branches. It results from this that the varicose bundle (*rouleau*) is found to be confined by it in a fold (*bourrelet*) of the integuments, and compressed only to the degree required to prevent the blood from passing through it. This fluid having ceased to circulate, solidifies, contracts adhesions, and ultimately blocks up completely the strangulated veins. As, by this method, we have neither eschar nor wound, the process of M. Sanson would be infinitely superior to that of M. Breschet if it was equally effectual; but I am convinced that it would not enable us to procure a permanent obliteration of the veins. So long as the vein has neither been divided nor inflamed in its interior, the blood which closes it has a tendency to be re-dissolved; gradually it becomes fluid, and in a short time we find that the channel of the vessel is reopened. Something, in fact, more effectual is required to obtain a radical cure of varicocele. I have seen but one patient who had been treated by

this kind of forceps : he was a student of medicine, and the varicocele, at the end of two months, had resumed its former size.

V. *Process of M. Reynaud.*—When we wish to adopt the method of M. Reynaud, we gather together, as in the processes above described, all the varicose veins in a fold of the integument, in order that we may introduce behind them a strong ligature by means of an ordinary curved needle, which pierces the skin twice. For greater security it would be advisable to pass in this manner two ligatures at about an inch apart. We then tie them firmly upon a small graduated compress, a piece of linen, a rouleau of diachylon or a dossil of lint ; and in order to be able to relax or tighten them at pleasure, we fasten each of the ligatures by a simple bow-knot. It happens necessarily that the ligature, by the constriction which it produces, divides the strangulated veins from behind forwards. After that takes place, it is to be removed, and this completes the operation. There is nothing more to do than simply to dress the wound which results from it, and to await the cicatrization.

The process of M. Reynaud has more simplicity and despatch, and less danger than that of M. Breschet ; and I have no doubt that it may, and will often, succeed. Nevertheless, the section of the veins by a single ligature, is too nearly analogous to their division by the bistoury, not to incur the danger of the re-establishment of their continuity, and the reproduction of the varicocele. By means, also, of the intervention of the small cushion recommended by M. Reynaud, the section, and likewise the obliteration of the veins, must necessarily be much retarded and difficult to effect. Nevertheless, this process is one of the best that has been devised.

VI. *Process of the Author.*—Struck, like most other practitioners, with the uncertainty or the dangers presented by the ancient modes of treating varicocele, I asked myself the question in 1830, if it might not be possible to substitute for them the method which I had made trial of on animals, with the view of obliterating the vessels. The conclusion I had arrived at, that a pin, needle, thread, or any foreign body whatever, left at rest from one to four days transfixing through a vein, arrested the circulation there with as much certainty as a ligature, naturally led me to try the processes which MM. Davat and Fricke proposed at a later period. But recoiling before the dangers of phlebitis and purulent infection, I conjectured that the venous bundle, (*pacquet veineux*,) strangulated upon a pin, might not be less efficacious, while at the same time it would be a protection against such results.

a. *Position of the Patient.*—The patient may either stand in the erect posture, rest upon his knees, be seated, or lie down. This last position, preferable in every other respect, has the inconvenience of not permitting the varicocele to be so prominent. It is necessary that the scrotum should have been previously shaved. The surgeon commences by identifying the vas deferens, which, situated in the rear of the cord, presents itself there under the form of a hard, elastic and regular stem (*tige*) of the size of a crow's quill

and the compression of which causes a pain similar to that produced by any pressure upon the testicle.

b. First Stage.—Having satisfied himself upon this point, the upper part (racine) of the scrotum is seized behind, while care is taken that the thumb and forefinger have a firm hold upon the vas deferens, and that the veins in front remain free. With the thumb and forefinger of the other hand we then draw towards us, and isolate the venous bundle while approximating it more and more to the integuments, in such manner that, being thus temporarily transformed into a sort of membrane placed edgeways (*de champ*) on the side of the scrotum, it encloses the veins in its anterior margin, and the vas deferens in its posterior border. The fingers remaining fixed between these two borders, serve as a point of support for the passage of the pins. An assistant seizes and holds one of the extremities of the tegumentary fold between the two orders of organs mentioned, while the operator holds the opposite extremity.

c. Second Stage.—Having besmeared the point of the pin with some unctuous substance, the surgeon inserts it transversely under the veins, and as near as possible to the anterior portion of the cutaneous border, and passes immediately a noose of thread under its extreme points. Another pin is placed in the same manner, at the distance of an inch from the first, and the operation is terminated. Although we may, if necessary, commence by the pin above, I would advise, nevertheless, to insert that below first, since it is always easier to find at this place, the space which separates the veins from the vas deferens, than it is in the vicinity of the ring. It is, moreover, important to avoid the two extremes, of placing them too high or too low, or too near or too far apart; if too near the testicle, the lower pin might pierce the tunica vaginalis, and give rise to a purulent inflammation, or an abscess in this small sac; if too near the ring, we might run the risk of not entirely separating all the veins of the cord, and of allowing some of those behind to escape; if too near together, the two pins might ultimately form but one wound, which would then be too large and too difficult to heal; to place them at a greater distance apart than I have recommended, would require them to be fixed too near the testicle below, and too near the inguinal canal above.

d. Third Stage.—As I have said in the article *Varices*, I have long been in the practice of strangulating the veins upon the pin, as in the suture for hare-lip; but in the fear of not effectually obliterating the vessel, I have adopted the plan of employing circular strangulation for varicocele, as well as for varices in general. An assistant consequently seizes the pin by its two extremities, and raises it with sufficient force. If he is afraid of pricking himself, or if the operator requires more room, the fingers of the assistant may be replaced by an erigne with a double blunt hook. In whatever manner the pin may be raised up, it is necessary to flatten down on the sides the tissues which it embraces. A cord of two or three threads waxed together, is immediately placed first above,

and then brought below the pin. Its two portions being passed like a simple knot, one over the other, are then drawn together with force, in order to strangulate circularly all the parts behind the pin, which latter by this means projects forward, drawing with it a noose of vessels. The point of the pin being snipped off by means of a cutting nippers, the operation is finished. It is also a matter of little consequence whether its head is turned in this or that direction.

e. Fourth Stage.—We may, if so disposed, withdraw the pins at the end of five or six days, and then leave the wound to cicatrize; but it is more secure to wait until all the strangulated tissues are separated under the form of an eschar. During that time, the patient may go about and pursue his ordinary mode of life. If the inflammation should be moderate, it is not even necessary to make any topical application to the scrotum. After the fall of the eschar, the ulcer which results from it should be treated like a burn in the fourth degree. The whole of the treatment by this mode lasts nearly a month, and the eschar comes away, or may be removed, from the tenth to the twentieth day.

f. Fifteen patients, (September, 1838,) affected with varicocele, have been submitted by me to this operative process; they have all been cured. There are four of them whom I have seen repeatedly, and one of these was operated upon in 1834. They have not the slightest appearance of a return of the disease, and in none of them did internal phlebitis occur. I have twice seen abscesses form in the vaginal tunic, and that when I have placed the lower pin too far down. In two others, the cord assumed considerable development and hardness about the ligature, which was caused in one of the cases by violent excesses in his diet, and in the other, probably, because I had deemed it advisable, for greater security, to strangulate the tissues again on the thirteenth day. These accidents, which were unattended with any other results, were relieved without sensibly prolonging the period of the final cure. One patient only, a young man who was almost an idiot, and who left the hospital at the moment when the inflammation had reached its highest intensity, because I insisted that he should stop jumping all day in the court-yard and drinking to excess, went off without my ever being enabled to know what became of him.

g. In fine, I can conceive nothing more simple than this process. The operation, while it is exceedingly easy, is finished in a second of time, and causes scarcely the slightest pain. If we remove the constriction as soon as the veins appear to be obliterated, the patient may be free by the eighth day. If, to be better assured of a radical cure, we wait until the strangulated tissues are detached, there will be no room to doubt of its efficacy. It is a method, therefore, more convenient in its application, both for the patient and the surgeon, than that of M. Breschet. As to the accidents it may cause, they are evidently the same as those of any other mode of strangulation; in this respect it is proper to arrange this method in the same class with those of MM. Reynaud, Sanson, and Bres-

chet. A thrust of the pin and a turn of thread constitute the whole operation.

VII. None of the modern methods of compression appear, up to the present moment, to have been followed by formidable accidents; while those by acupuncture, or incision of the veins, have frequently caused death. A fundamental difference, then, exists between these two orders of operative processes. By compression, either as M. Reynaud understands it, or with the forceps of M. Breschet or M. Sanson, or by the mode that I prefer, the coats of the veins inflame upon their exterior only; and their walls being held for a considerable length of time in contact, become adherent, and ultimately blended together, before the purulent secretion has had time to establish itself upon their interior surface. It is altogether the reverse in acupuncture or incisions. Here the pathological process which it is designed to bring about, establishes itself at the first—not on the external, but on the internal surface of the vein; from whence it follows that the pus, if any is formed, may mingle with the blood and infect the system. I should, however, remark, that internal phlebitis of the scrotum, spermatic cord, and penis, which I have often observed under circumstances disconnected with varicocele, has never been followed by that train of symptoms of poisoning which accompany it every where else. Can there be, in those regions, a particular arrangement of nature to prevent purulent infection; or were not the cases, observed by me, those of exceptions to the general rule? Certain it is, that the puncture of the veins of the cord does not appear to have been attended, in the hands of M. Fricke, with those internal accidents which it has frequently given rise to when it has been applied to the veins of the limbs.

[VARICOCELE—OBLITERATION, ULCERATION AND WOUNDS OF VEINS, &c.]

J. L. Petit (*Du Varicocèle, et de sa Cure Radicale*, par le Docteur J. Helot, Archiv. Gén. de Méd., Sept., 1844, p. 3) mentions a case of varicocele in which the bunches of dilated veins of the cord and scrotum, had acquired in their aggregate volume the size of a child's head!

In regard to atrophy of the testicle which some have asserted to be a consequence of varicocele, the observations of MM. Breschet, Landouzy and Helot (Loc., Op. cit., p. 5) only go to show that the testicle on the side affected is softer and somewhat diminished in size. Another constant symptom according to M. Landouzy (Op. cit.) is an abundant cutaneous exudation from the side of the scrotum affected, and sometimes also a species of eruption, says M. Helot, on the corresponding part of the thigh, (Ib.)

The general opinion entertained, and which is corroborated by the observations of MM. Morgagni, Sir Astley Cooper, &c., and also by those of our author, M. Velpeau, (Vid. text supra,) that varicocele is far more frequent on the left than right side, because

on the right side the spermatic vein enters the vena cava ascendens in a direction almost parallel with the axis of the vessel, i. e., with the course of the blood, while the left spermatic vein empties into the emulgent at a right angle, i. e., in a direction perpendicular to the current of the blood which comes from the loins, is contested by M. Helot. So also does this author deny the alleged predisposition to varicocele on the left side, because of the compression made on the operative vessels on this side by the stercoral matters accumulated in the iliac portion of the colon, as Callisen (t. II., p. 112) and J. L. Petit pretend. The cæcum, according to M. Helot (Loc. cit., p. 11,) ought to have a similar effect on the right side, in which location however varicocele is exceedingly rare. In relation to the pressure of these fæcal matters on the veins of the cord, their effect too, says M. Helot, ought to be more pernicious when the patient is in a horizontal position, the reverse of which is the fact. Besides, a collection of these matters and constipation are not common in young men, who are the most frequent subjects of varicocele. He nevertheless admits the prevalence on the left side, but confesses his ignorance of the cause. Delpech even denies that varicocele is observed among young men, except in rare instances. M. Helot asserts that he is satisfied from the observations he has made at La Charité under MM Velpeau and Ricord, that it occurs most frequently between the ages of 10 and 35, which agrees with the experience of M. Landouzy, (Loc. cit., p. 13.) Varicocele consists more, M. Helot thinks, in the abnormal development of the venous branches than in the dilatation of the principal trunks. He does not consider it proved by any means that masturbation and excessive venery are a frequent cause of this disease, nor that it is more frequent in hot climates; since M. R. Marjolin in his Thesis (1837) establishes the fact that 60 out of every 100 in France have it to a greater or less degree. M. Helot also doubts with M. Ricord if blenorragic epididymitis be a common cause of varicocele. It is true however, he thinks, that varicocele as M. Blandin asserts (Dict. de Méd.) may be transmitted by an hereditary predisposition. A diagnostic mark is the power of separating with the fingers each of the varicose cords, which are semi-fluctuating, knotty, and resembling a bunch of leeches, all upon, but distinct from, the testicle. He disapproves altogether of preventive surgical operations, and advises to leave the disease to itself or a suspensory.

The great point is to know when to operate and when not—nor should an operation ever be undertaken except in a case of extreme necessity which very seldom happens. The annoying pain must be subdued by palliatives, and is no more a reason for a surgical operation than the pain of corns is for amputating the toe.

When palliatives fail, and the tumor is enormous, and the pain so intolerable as to disable the patient from attending to his pursuits, and where the accidents are serious and imminent, there only is an operation justifiable.

In a case where a varicocele of inconsiderable size but of long

standing, in a gentleman of education and otherwise of sufficient moral firmness, had by the continuance of pain greatly impaired his general health, and caused a permanent melancholy or hypochondria, Dr. Mott at his earnest solicitations was induced to remove the testicle on the side affected, which brought about a radical cure and entire restoration of strength and spirits and general health.

Process of Rolling up the Veins, (l'enroulement de veines,) a New Process for the Cure of Varicocele, proposed by M. Vidal de Cassis.—M. Vidal, having adopted the process of M. Reynaud, modified it in the following manner: a thread of silver was passed by means of a needle behind the spermatic cord in its fold of skin, and kept well separated from the vas deferens. This thread was knotted upon a small roll of bandage acting as a cushion; a canula was adjusted above the knot which answering to the stick of the old artery compressor, served from time to time to increase the constriction, or to diminish it when the pains were too severe. Towards the 15th day all the veins were cut by the thread, and to remove this, all that was necessary was to wait for the ulceration of the integuments, or to divide the cutaneous bridge under which the ligature was situated. After employing this mode for some time he abandoned it as objectionable because of its not effecting a perfect cure, but on the other hand exposing to a return of the disease; since it interrupts the venous circulation at a particular point only of the spermatic cord, so that the circulation may thus be re-established in the obliterated veins. He now proposes the following method, (See account of his memoir, *Bull. de Thérap.*, Mai, 1844.—*Archiv. Gén. de Méd.*, Sept., 1844, p. 108, &c.)

1. A [strong] silver thread is passed behind the cord by means of a needle, as in the process of M. Reynaud as modified by M. Vidal.

2. Another silver thread [of less size] is passed in front of the cord in the same manner and through the same openings. The venous bundle is thus placed between two threads, under the skin, [constituting a sub-cutaneous ligature. T.]

3. The two threads are twisted together at each of their extremities; "as this torsion is continued the two threads are more and more tightened, and tend to form a cord which makes a certain degree of resistance. This metallic cord, in turning on its axis, makes traction (*entraîne*) during its movement of rotation, upon the parts included between the two threads which compose it. The veins are by this means rolled up upon this double thread, after the manner of a rope upon a capstan. The greater the number of turns made the higher the testicle mounts upward, while the laxity of the cellular tissue of the scrotum favors the movement of ascension."

4. Finally a small roll of bandage (*petit globe de bande*) is placed upon the skin, and the two ends of the rolled up metallic cord are fixed upon this plug (*tampon*) by another torsion, then a canula is passed underneath, as in the process of M. Reynaud modified as above by M. Vidal.

It will be better, M. Vidal says, to allow the threads to cut through the skin, for we shall then not only have a division of the veins of the cord at different heights, but also that of the superficial veins, running between the cord and the skin, the strangulation of which presents another obstacle against a return of the disease. M. Vidal appears to think that the radical cure of varicocele should be attempted in all cases, inasmuch as its continuance occasions more or less pain, and great fatigue from exercise, and sometimes serious inflammation, *atrophy* of the testicle, impotency, &c. On the other hand, the editors of the *Bulletin de Thérapeutique*, commenting upon this process, think that in a great majority of cases patients are made quite comfortable and free of pain, by properly contrived suspensories, [See in Vol. I. of this American Edition, a suspensory used with great advantage at the Seaman's Retreat, New-York. T.] While the surgical processes of a ligature upon the spermatic cord are known in two or three instances, (and it has happened probably in several others,) to have caused death by phlebitis or other accidents; [in one case death by tetanus. T.]

Considering, therefore, the general harmlessness of this disease, surgeons prefer the palliative mode, or, if an operation is to be resorted to, they would recur then, and not till then, to the processes of MM. Gagneb , Ricord, Reynaud and Vidal.

It is due to our author, M. Velpeau, to say that at the sitting of the Paris Academy of Medicine, Aug. 6th, 1844, (*Journal des Connaissances M dico-Chirurgicales*, Sept. 1st, 1844, p. 126,) he, as one of a commission to whom the memoir of M. Vidal above-mentioned had been referred, reported upon this new process of *enroulement de veines*, in which report it is stated that two of the committee had examined, at the Hospital of Lourcine, two patients upon whom M. Vidal had operated with success by his method. The reporter adds, however, that the process is not so simple as those that are known; that it is not more dangerous than the processes of MM. Breschet and Reynaud, (of Toulon;) but that it is at present impossible to decide if it exposes less to a return of the disease.

M. Curling (London Lancet, June 15th, 1844, p. 388) has cured several cases of varicocele by making pressure at the external ring by means of the *moc-main* truss, whereby the gravitation or hydrostatic pressure of the blood in the dilated spermatic veins "was prevented."

Excision of all the lower part of the scrotum, preserving to it its natural, oval convexity downwards, is another mode recently made trial of for the cure of varicocele, under the expectation that the permanent retraction obtained by the curtailment and diminution of this envelope, would effectually keep up the testicles, and ultimately by its compression, cause the varicose venous bunches of the cord to resume their normal calibres. The idea appears to have first suggested itself to our author, M. Velpeau, many years since, from having noticed the salutary contraction of the scrotum produced by the cicatrix left after an accidental sloughing of the teguments in a case at La Charit , in which M. Velpeau had ope-

rated on the varicose veins by his process with pins. However, he accords (See Report in the *Clinique Chirurgicale* in the service of M. Velpeau, à la Charité, in the *Journal des Connaiss.*, &c., de Paris, Decemb., 1844, p. 223, &c.) the first conception and the priority of the operation of excision of the scrotum to M. Bransby Cooper of London, about the year 1840. From seeing a case at Paris, which had been operated upon by M. Cooper, though leaving a bad cicatrix, M. Velpeau was induced nevertheless to make trial of it at La Charité. If, however, we are to believe the statements in the report of M. Velpeau's Clinique, as furnished to the *Journal des Connaissances*, (loc. cit.) but which, from the rather acerb tone in which the commentaries of the anonymous reporter, M. A. G., are couched, must be received, we think with caution, M. Velpeau had at that time, viz., up to Nov. 14, 1844, performed this operation on *three* patients, in all of whom the contracted scrotum had again become clongated by the weight of the testicles and enlarged veins, in fact reproducing the disease in as bad a state as ever. It is due however to our author, to state his mode as it is therein given, (loc. cit.) of performing what he denominates the *English Process*. The patient being laid on his back, the surgeon seizes the lower portion of the scrotum, and raises it up vertically, so as to crowd the testicles back, which he does without any difficulty, upon the pubis, in order to remove them out of the way of the instrument. He then stretches in a transverse direction the fold of scrotum which had been just raised up, and does this with such force, that it readily becomes transparent to the light. The limit beyond which the excision is to be made, is established either by means of the fore-finger and thumb of an assistant, or by two sounds, one on either side, which compress the fold of scrotum between them, and are kept firm upon it by having their extremities made fast. A few lines beyond this curved line of demarcation are inserted at short distances from each other, *ten pins*; and on a line a short distance beyond these again the bistoury rapidly makes the required excision, the thread for each pin being fastened around its extremities the moment after the knife has cut beyond the point where it is inserted. The sutured parts are then dressed with the perforated linen spread with cerate, and a compress and appropriate bandage. The cicatrization is usually completed in a few days.

Pathological Diagnosis to be obtained from Varicose Veins.—It would, *a priori*, as it seems to us, be a rational pathological inference to assert that where the venous trunks externally become hypertrophied on the abdomen to the extent that they sometimes do, though incomparably less so than on the lower extremities, that this disorganization resulted from some internal organic difficulty and obstruction; the same as the hemorrhoidal dilatations, tumors, and bleedings indicate to a certainty more or less organic derangement of the liver, lungs, and other viscera.

Thus we find a case related (London, Guy's Hospital Reports, October, 1844,) of a carpenter, aged 36, who, after many excesses, was received into the hospital for ascites, and in the right side of

whose abdomen the superficial veins had acquired the *size of the finger*. Death occurring shortly after abstracting a large quantity of a clear greenish liquid, showed an enlarged liver, but especially an enlargement of the right kidney, which was *four times* its normal dimensions, and filled with fungosities and tubercles of brownish, reddish, and yellowish color; while the vena cava ascendens was filled to the extent of 6 or 8 inches with a similar fungoid substance, extending into the right auricle, with thickening and degeneracy of the coats of the cava and other marks of extensive degeneration throughout the principal venous trunks of the abdomen.

M. Guérin, in remarking (*Gaz. Méd. de Paris*, June 7, 1845, Tome XIII., p. 363,) on the paper of M. A. Bérard, (See our abrégé of this paper *supra*, under arteries,) in the Archives Gén. de Méd., (Janvier, Février, et Mars, 1845,) on a new form of aneurismal varix, in which an aneurismal *intermediary* tumor is formed much more frequently, M. Bérard thinks, than authors suppose, between the vein and artery, observes that the close juxtaposition (intime accollement) of those two vessels, (an anatomical condition indispensable for their simultaneous lesion to take place,) renders it difficult for us to comprehend the ulterior development of an aneurismal canal between them. M. Guérin also adds that the gradual distension, in the form of a pouch, of the cellular tissue between the cicatrix of the skin and the wound of the superficial wall of the vein, seems to be a phenomenon much more in relation with what we know of the organization of these parts.

WOUNDS OF THE VEINS, &c.—*The Lateral Sinus of the Brain Ulcerated*.—Mr. Syme, in a communication to M. Liston, which the latter surgeon referred to at a meeting of the Royal Medical and Chirurgical Society of London, April 11, 1843, (*Cormack's Journal*, Oct. 1843, p. 945–6,) states that he tied the carotid in a boy, for bleeding from the ear after suppuration. The patient died, and an opening was found into the lateral sinus just above where it passed into the internal jugular. Mr. Bloxam (*loc. cit.*) has also seen a case of an abscess communicating with a vein.

Obliteration of large Venous Trunks, Vena Cava, &c.—Dr. Peacock exhibited to the Anatomical Society of Edinburgh, at their meeting, Dec. 20th, 1842, (*Cormack's Journal*, Feb. 1843, p. 170,) a specimen of *complete obliteration* of the vena cava ascendens, taken from a woman aged 47, who died laboring under general dropsy and hematemeses. The lower extremities were œdematous, the left lung diminished, and bound down by fibro-cartilaginous adhesions, the heart healthy, the liver small, and covered with a network of dilated veins, which also ramified upon the abdominal surface of the diaphragm, the kidneys atrophied, and in an advanced stage of granular degeneration, and the veins in the substance of the uterus and in the broad ligaments distended by hard decolorized coagula, which were also found in the iliac veins, and in the vena cava ascendens, as far as the sulcus hepatis. At this point the trunk of the vena cava was impervious, and converted into a hard white cord of about the thickness of the little finger. The coats

of the vein and its different branches were thicker and firmer than natural, and its canal throughout was contracted. The clots were regularly laminated, somewhat resembling the *fibrinous layers of an aneurism*, and adhered to the sides of the vessel. The coats of the vein became gradually thicker as it advanced towards the heart, till the two sides entirely adhered. The obstructed portion extended from the point of entrance of the hepatic veins, to immediately below the right auricle. The vena azygos, as well as the spinal and lumbar veins, were greatly distended. These appeared to have been the channel by which the circulation was maintained. From the net-work of dilated veins which existed on the liver and diaphragm, Dr. Peacock conceived that the portal system assisted in facilitating the backward flow of the blood. There was no enlargement of the abdominal veins. He considered the immediate cause of the obstruction or obliteration to be inflammation of the vascular coats, (i. e. phlebitis.)

Remarks.—If the entire mass of blood that returns to the heart through the ascending cava, constituting at least three fourths, if not more, of all the venous blood of the body, inasmuch as it comprises nearly all that comes from below the clavicles, can be thus totally cut off for (as it must have been) a very considerable period of time, to allow of such obliteration to take place—it is, we conceive, an *à fortiori* argument in favor of the ultimate practicability of yet preserving the life of the patient when a ligature has been placed upon the arteria innominata, which furnishes perhaps only one half the supply furnished to the neck, upper extremities, and head. This interesting case of Dr. Peacock, furthermore, establishes the important fact, that even so large a venous trunk as the cava ascendens, laboring under all the disadvantage of walls or coats of great tenuity and weakness, when compared with arterial trunks of corresponding calibres, may nevertheless undergo the complete process of agglutination, consolidation, and obliteration. This, therefore, is another acquisition from pathological anatomy, in favor of the entire success which it is hoped may one day attend the operation of the ligature on the arteria innominata and all other great arterial trunks.

Rupture of the Right Internal Jugular into an Abscess.—As one of the evidences of the necessity of early preventing or removing all pressure by tumors, abscesses, &c., upon tissues so crowded as those of the neck are with large arterial, venous, and nervous trunks, and other vital canals, as the thoracic duct, trachea, œsophagus, &c., we may, as a suitable illustration under the head of *veins*, in addition to what has already been said by the author on a still more important subject, viz., phlebitis, pus, and air in veins, &c., instance the case related by Mr. Alexander King of Glasgow, (Cormack's Lond. & Edinb. Month. Journ. of Med. Science, March, 1843, p. 1, &c.; the case belonged to Mr. John Brown, surgeon,) of death in a boy, aged four years, in consequence of an *actual rupture of the right internal jugular* into an abscess which had formed in this part of the neck after an attack of scarlatina. This abscess was

preceded, as is common in scarlatina, by an extensive tumefaction of the oblique chain of sub-cutaneous lymphatic glands, extending from the parotid to the scapular extremity of the clavicle. It broke of itself on the 16th day, by a small opening through which the contents of the abscess were freely evacuated, so that the swelling gradually subsided, until on the third day after this, blood was found to ooze from the aperture in a full stream. The walls of the abscess were very tense, and the tumor now about the size of a hen's egg was larger, the mother said, than before; it occasioned paroxysms of coughs and dyspnœa, and then became more tense and prominent. Pressure on the carotid did not alter its size, but on the tumor itself, brought on a fit of coughing immediately, without appearing to displace any of its contents. The pulse extremely quick and feeble, and occasionally intermitting; countenance pale and blanched. Pressure to the tumor by compresses and bandaging, in order to facilitate coagulation, was attempted; but, as it brought on incessant coughing, it was first abandoned, then tried again; but the tumor continued to increase the evening of the same day the surgeon had been sent for, on account of the hemorrhage. The tumor, in fact, now interfered so much, by its size, with respiration, that the bandaging had to be again relaxed; but upon removing this altogether, in order to proceed to an examination, the child was seized with a violent paroxysm of coughing, during which the anterior wall of the tumor gave way to the extent of two square inches. A thin coagulum, about the size and thickness of a crown piece, was ejected, followed by an immense gush of blood. "I instantly," says Mr. King, "introduced the first two fingers of my right hand into the opening, and surrounded the fingers and the tumor with cloths, and very little blood was afterwards lost, although my fingers could not get either to the upper or lower orifice, in consequence of the lower part of the tumor being covered by the parotid gland and sterno-cleido-mastoid muscle. When my fingers were first pressed into the abscess, I felt blood flow freely downwards from above, and propelled upwards with a great force, during each forcible expiration. A state of syncope followed in a few seconds, and he expired shortly afterwards."

Dissection was made ten hours after death. The swelling had entirely disappeared, and the skin which had previously covered the tumor, had contracted in every direction, so that it could hardly be conceived that so much distension had ever existed. The tumor from the lobe of the ear downwards was divided into two sacs, which communicated very freely. The one extended below the digastric muscle and parotid gland, and to the base of the skull; while the other had the parotid gland for its posterior wall, the sterno-mastoid muscle for its external, and the platysma, fasciæ and skin for its anterior wall. Dividing through the parotid, which was sound and healthy, and the posterior belly of the digastric, a distinct view of the course of the hemorrhage was obtained. *Nine tenths of an inch* (continues Mr. King) of the external wall of the internal jugular vein, commencing two lines below the base of the

skull and extending downwards, was completely removed, as if by a sharp scalpel. The external wall, and even the margins of the opening, were perfectly healthy, and of the normal pearly white color. The common carotid was also perfectly healthy; so were the walls of the abscesses and all the surrounding tissues.

Remarks.—A case so unparalleled could scarcely have been diagnosed by any one. The attempt at a ligature would probably have ended fatally by hemorrhage before the lesion could have been cut down to and secured above and below it; while compression was defeated by the regurgitation or reflux of blood from the right side of the heart during the paroxysms of the coughing. Nor, (as Mr. King says,) could the ligature have been applied to the wounded vessel between the laceration and the base of the skull. Add to all which, the child, had the laceration been freely exposed, would probably have suffocated on the spot, from unavoidable inhalation of air into this large venous trunk. So no blame could any way attach to the surgeons. Professor Fergusson of London, (See M. Liston's recent memoir on a *variety of False Aneurism*) relates a somewhat similar case. In this also no operation was resorted to, because of the debility of the child, which died suddenly from hemorrhage. On dissection, the blood was found to have proceeded from an ulcerated opening in the *lingual artery* near its origin from the carotid.

Such facts should indeed, as Mr. King says, impress surgeons with the extreme danger of opening as is so often recklessly done, abscesses in the neighborhood of large vessels.

Scrofulous Abscess with Perforation of the Jugular Vein, and death.—Dr. Hoffman, also (Caspar's *Wochenschrift*, March 30th, 1844—quoted in Cormack's *Journal*, July 1844, p. 632,) relates the case of a child aged five, in whom scarlatina was followed by abscesses in the chain of sub-cutaneous lymphatic glands, on the right side of the neck, and which glands, on both sides of the neck from the parotid to the clavicle are, as is well known, and as we have already said, usually found involved in severe inflammation and tumefaction in that form of eruptive fever. Though a certain suspicious tremor and bruit accompanied the fluctuation of the tumor, it was nevertheless punctured, when a copious stream of blood immediately issued out and revealed the true nature of the mischief. At first the discharge was of a dirty red color, doubtless from the admixture of pus, but soon changed to pure blood, terminating in a few minutes in death, notwithstanding the compressing means used. The corresponding *external jugular vein* was found *perforated like a sieve* to the extent of three quarters of an inch of its calibre, the portion of the vessel above and below this point, being also discolored and soft. The abscess being situated over the vein had in fact extended to its walls and perforated them.

Ossification and obliteration of the Vena Porta.—M. Gintrac relates a case received in the hospital at Bordeaux, (*Jour. de Méd.*, de Bordeaux, quoted in the *Gazette Méd.*, de Paris, March 1844, and Cormack's *Lond. & Ed. Journal*, July, 1844, p. 621,) also la-

boring under ascites, like the one above and with dyspnœa, palpitations, and abnormal sounds of the heart. After death there were found the following appearances on dissection: the heart of large size and the lining membrane of the aorta reddened and containing cartilaginous deposits; the liver pale, small, and with irregularities upon its surface; the gall bladder occupied by a moderate quantity of thin yellow fluid, and the gall ducts natural; but the vena porta above the point of junction of the splenic and superior mesenteric veins, was filled by an old and pretty firm clot adhering to the lining membrane, and of a dark color. At the same point the coats of the vein presented several osseous laminæ of an angular form. They were situated between the inner and middle coats and slightly adherent. *All the veins of the abdomen* communicating with this vessel, were gorged with blood and varicose. M. Gintrac thinks with good reason that the ascites was the consequence of the obliteration and ossification of the vena porta, and remarks that though this obliteration was complete, yet the secretion of bile was not suspended, but *only altered*, while the nutrition of the liver had evidently been arrested, and that consequently the blood of the vena porta seems to have a share in the nutrition of the liver, and not to be exclusively indispensable to the secretion of bile.

Cicatrices of Arterial and Venous Wounds.—M. Amussat is satisfied, from his experiments on animals, and his observations on man, (*Recherches Experimentales sur la Formation de Cicatrices Arteriellles et Veineuses*, presented to the Academy of Sciences of Paris, Feb. 20, 1843. See *Journ. des Connaiss.*, &c., of Paris, Mai, 1843, p. 215–216,) that surgeons are too much in haste to plug up wounded arteries and veins, and do not depend sufficiently upon the efforts of nature. He believes, with J. L. Petit, that such wounds will, of themselves, if properly treated, frequently form spontaneous solid cicatrices. This memoir strongly corroborates the views of our author in the text, especially the cases of the cure M. Velpeau relates, (see our vol. I.,) of hemorrhage and aneurismal tumors consecutive upon wounds of the brachial artery in bleeding; but in M. Velpeau's cases, indirect compression over the wounded part was the means employed.

M. Amussat states that *arterial cicatrices* are never formed by the immediate reunion of the lips of the wound of the vessel, but always by the interposition of a *fibrinous* clot, which becomes agglutinated to the border of the opening, afterwards indurated and organized, and then takes all the characters of the walls of the artery with which it becomes identified.

To obtain solid and permanent arterial cicatrices, we should, says M. Amussat, properly support the clot, weaken the *impulsion of the heart*, and preserve the part in a state of complete immobility; in a word do the same as for fracture of the bones, that is, fulfil all the conditions requisite to procure legitimate (*véritable*) consolidation.

These experiments on animals, and some facts he has noticed on man, have proved, he says, that *venous cicatrices* are formed on man

as upon animals. The only practical result to be deduced from this fact, is the necessity of maintaining a *proper degree of compression*, for two or three days or more after the wound of the vein.

In regard to the opinion M. Amussat expresses, that it had been generally considered an established fact that arteries would not firmly, (solidement,) [and spontaneously,] cicatrize; we consider this surgeon to be laboring under a great error, inasmuch as such spontaneous agglutination, consolidation and reunion, must have been familiar to every one from time immemorial, in all wounds of smaller trunks, particularly when aided by direct or indirect compression.

We perceive by the importance he attaches to a diminution of the *impulsion of the heart*, and to *compression*, that M. Amussat fully appreciates, (without, however, we believe, specifying it in his Memoir,) the new and successful mode of curing aneurism by these means, first made known in Dublin, by Dr. Hutton, in the year 1842, (See our note on this method above,) *i. e.*, a year before M. Amussat's Memoir was given to the public.

In a more recent memoir of M. Amussat, communicated by him to the Academy of Sciences, October 28, 1844, (see *Journal des Connaissances Medico-Chirurgicales*, de Paris, December, 1844, p. 259, et seq.) upon the subject of wounds of the blood vessels, and especially the question, what are the phenomena that are immediately noticed at the extremities of arteries and veins that have been completely divided through by a large and transverse wound, has, by the researches which he instituted to resolve this problem, felt himself authorized to come to the following conclusions:—

1. When an artery, thus divided transversely in a large wound, ceases spontaneously to bleed, it is an error to suppose, as most persons do, that this is effected by a spasm, crethysm, or contraction, of the artery.

2. The cessation of the hemorrhage is caused by a physical impediment, a clot of blood which shuts up and completely obstructs the extremity of the vessel.

3. This gives the appearance to the cut end of the artery, of a small red conical or mamellar point, a sort of stump which is lifted up at every pulsation of the heart. It is the plugging clot, (*bouchon obturateur*;) seen in animals as well as man.

4. This *bouchon* or plug or clot is a species of cap (*capuchon*) or *hollow cone*, agglutinated (*soudé*) to, and identified with, the border or periphery of the artificial opening, and particularly with the cellular membrane. The arterial tube is thus in fact prolonged into the clot, and terminates in a *cul-de-sac*. If this conical clot is divided transversely at different distances between its apex and the extremity of the divided artery, we find a hole or central canal whose diameter diminishes in proportion as we recede from the place where the vessel was divided. This fact explains perfectly the progressive diminution always noticed in the jet of the blood, and also accounts for the plugging up of the artery.

5. The fact of the formation of this clot is of great importance in

surgical practice ; *for instead of searching for the gaping orifice of a divided artery, as we are taught in lectures and books, we must look for the clot and not for an arterial opening* (lumi re) as in dead subjects after operations upon them.

6. Hence the difficulty of finding these conical projections in those who are not familiar with operations on the living body and living animals, and hence the dangers which ensue. The department of *vivisections* therefore imperatively demands the attention of students.

7. Therefore, also, we should not abandon too hastily the search for these pointed clots, otherwise, notwithstanding compression and tamponing, dangerous consecutive hemorrhage may occur.

More recent experiments on dogs by M. Amussat, (read to the Academy of Sciences of Paris, Dec. 16, 1844.—*Vid. Archiv. G n. de M d.*, Paris, Jan., 1845, p. 108,) show that in the spontaneous cessation of hemorrhage after wounds of arteries, the plugging clot (*caillot obturateur*) forms even in the *largest trunks*, as the carotids for example, though both may be divided at once. Even in this last case death is not produced immediately, but life maintained for some minutes during which the animal retains all his faculties, and the spontaneous clot is formed whether the animal dies from or survives the hemorrhage. This clot is formed by two separate clots, one outside (*ext rieur*) the other interior which consists of a coagulum similar to that formed after artificial means of occlusion. (See our notes on this subject of the internal and external clot, under the head of arteries, *supra*.)

Arteries.—*Blood.*—Professor Huenefeld of Gr fswald, in his late work, (*Chemie und Medicin*, &c., Berlin, 1841, p. 118,) draws attention to the curious fact of the lining membrane of the arteries being composed of *fibrinous protein*, and hence not liable to be acted upon by weak alkaline solutions. Whereas if it had consisted of the albuminous protein, it could not have withstood for any length of time the incessant contact with alkaline blood.

M. Velpeau, in a letter to the Academy of Sciences of Paris, in vindication of his claim of *priority* for his method of treating varicose veins and varicocele, and a copy of which has been transmitted by the Professor of La Charit  to Dr. Mott and myself, thus expresses himself under the head of *varices and varicocele* ; It was in the year 1840 that M. Davat (of Aix) alleged that I had availed myself of his process for the treatment of varices. This process consists in the passage of a pin underneath the vein we wish to obliterate, then of a second pin which crosses the first at a right angle, and which twice transfixes (traverse) the vessel through and through and in the direction of its length.

I never (says M. Velpeau) employed the process of M. Davat, and I never made any claim to its invention, although the two elements of which it consists are evidently based upon my researches on the subject of the acupuncture of veins, published in 1830. The proof that my process for varices does not belong to M. Davat, lies in this, that this physician himself speaks of it as follows

in a memoir published by him in 1836, (*Traité Curatif des Varices*):—

“M. Velpeau, at La Pitié and La Charité at Paris, and M. Franc, at the hospital of Saint Eloi at Montpellier, have employed a method (*un moyen*) which, though as simple and innocent as mine, (*le nôtre*), appears to us to be far from possessing the same efficacy. Already, in our first trials, (*travail*), though we occupied ourselves but very little with this mode of compression, because we were aware that it had been proposed by M. Velpeau, (*Médecine Opératoire*, 1832,) we made known some experiments which were but little favorable to it,” (p. 2.)

And further, (p. 20): “to the process of M. Velpeau there is in my opinion these objections, viz., its uncertainty (*infidélité*) unless the constriction is made with a sufficient degree of force and constantly, and because, in the contrary case, of its being attended with as much danger as the immediate ligature.”

We thus see (says M. Velpeau) that M. Davat, far from claiming this process, does himself attribute it to me, quotes it from me, and repudiates and denounces it five or six years after I had published it.

SECTION VI.

THE LYMPHATIC SYSTEM.

The operations required by the lymphatic system are applicable only to the ganglionic (i. e., glandular) portion of this part of the organization. But as on the other hand the diseases of the lymphatic glands which occasionally call for surgical aid, almost all of them present themselves under the form of tumors, I shall have an opportunity of speaking of them while treating of this last mentioned class of affections.

SECTION VII.

THE NERVOUS SYSTEM.

Though most authors upon operative surgery have neglected to treat of the nerves, they are nevertheless liable to a number of diseases which often require its interposition.

Among the affections of the nervous system, there are two especially which I cannot omit to treat of in this point of view: These are the neuromas (*les névromes*) and the different kinds of neuralgia. The nature of neuromas and tumors of the nerves being still a subject of dispute with pathologists, induces me to consign (*rejeter*) them also to the class of tumors. I shall consequently at present treat only of operations which are admissible for neuralgia, in other words of the section and excision of nerves.

It was natural to suppose that in destroying the continuity of the sensitive nerves, we should thus prevent the transmission of the pain to the brain, and succeed in curing the neuralgia. As the nerves on the other hand have no retractility, it was apprehended that after being divided they might reunite anew, and that their mere division would not be followed by any permanent relief. Experience unfortunately has too well confirmed these anticipations. It was on that account that the idea suggested itself of destroying a sufficient portion of the nerve to render its reunion impossible. Caustics and the hot iron recommended to carry out this recommendation have the serious inconvenience of making too large a cicatrix and horribly disfiguring the patient. In our times the cutting instrument has generally been substituted for them. By means of an incision in the track of the wrinkles (*rides* or *rugæ*) of the skin, the muscular fibres or the principal vessels, we are enabled to lay the nerves bare at their exit from the bone, to divide them before they have given off any branch, and to remove a portion of them of the length of some lines. The wound cicatrizing by the first intention, the scar, after the cure, is lost in the folds of the skin, and the continuity of the nerve being effectually destroyed, it seems impossible that the neuralgia should not be arrested.

It is far from being true, however, that clinical observations on this point have never contradicted the theory. Often, and too often, the disease does not yield either to excision or incision performed in the very best manner, and there are numbers of persons who have been no more benefited by one of these operations than by the other, no more than they have been by deepest cauterizations. There was at the Hospital of St. Antoine, in 1829, a man of about 45 years of age, who, for the space of fifteen years, had been affected by a *tic douloureux*, and who had undergone successively the section and excision of all the nerves of the face, but without experi-

encing any relief whatever. As, however, more fortunate results have been stated, we may, when we have unavailingly made trial of all other modes of treatment, and the sufferings of the patient are exceedingly acute, suggest to him the exsection of the nerves as a last resource, which it would be uncharitable, perhaps, to deprive him of in certain cases of obstinate neuralgia.

CHAPTER I.

NERVES OF THE HEAD AND NECK.

So common are neuralgias of the head, and so excruciating is their pain, that it has often been proposed, when all our resources of hygiene and pharmacy have failed, to have recourse to cauterization, or the section or excision of the nerves supposed to be affected. There are, moreover, a great number of the nerves of the head which it might be advantageous to subject to this treatment. The chief of these, besides the branches from the cranium, are the frontal, infra-orbital, inferior dental, the facial and some branches of the superior dental.

ARTICLE I.—NERVES OF THE CRANIUM.

Many authors have mentioned neuralgias established in the head as a consequence of wounds, and which have yielded only to incision or excision. A young girl, for a long time subject to convulsions, epilepsy, and neuralgia of every variety, was instantly cured by an incision which Pouteau (*Œuvres Posthumes*, t. II., p. 83, 86, 92,) made above the mastoid process, the part upon which the patient had received a blow a long time before. In another patient, Pouteau had recourse, in the same way, to three incisions upon different points of the cranium, and was not less successful than in the preceding case. The same author succeeded with a similar operation performed upon the cranium of a young man, aged 24 years, who had fallen upon his head sixteen years before. In these three cases, Pouteau confined himself, it is true, to incision, but he tamponed the wound, and did not unite by the first intention.

ARTICLE II.—NERVES OF THE FACE.

The face is the part upon which the section or excision of the nerves is most frequently performed. It is probably also the region where the operation is least apt to succeed.

§ I.—*The Frontal Nerve.*

When we wish to derive all the advantage possible from the ex-

cision of the supra-orbital nerve, we should seize it at the moment when, as it emerges from the supra-orbital notch, it is reflected backward close to the bone, and before the outer and inner anastomosing branches are given off from it, for the purpose of insculating with the surrounding nerves. In that part it is covered only by the skin, a thin lamellar tissue of cellular substance, and some pale fibres of the orbicularis palpebrarum muscle. The artery which runs by the side of it is not of sufficient size to create any apprehension of wounding it, and in the neighborhood there are no other organs that the instrument can encounter. Should we not be enabled to identify the nerve at first, all that will be required to determine its position will be, to recollect that the groove or hole which gives passage to it, is situated at the union of the inner third with the outer two-thirds of the upper orbital arch, that is to say, at about an inch outside of the root of the nose, and that by following the border of the orbit with the point of the finger, from the nasal process to the temporal process of the frontal bone, we have it almost constantly in our power to ascertain its exact locality.

A. The operator, placed behind the patient, raises the eye-brow with his left hand, and while an assistant depresses the lids, he again makes himself sure of the position occupied by the diseased nerve, seizes a straight bistoury with the other hand, and holding it as a writing-pen, directs the point upon the internal orbital process, draws the instrument upwards, then outwardly, and divides all the tissues down to the bone to the extent of an inch, a little above, and in the direction of the adherent border of the eyelid; he then gently separates the edges of this semi-lunar wound; finishes the section of the nerve if it is not completed; hooks up the anterior portion with a good pair of dissecting forceps; isolates it, and excises a sufficient extent of it to prevent the possibility afterwards of a reunion of the two extremities.

Nothing now remains in the way to prevent our proceeding at once to reunion of the integuments by first intention. The loss of substance which the nerve has undergone, gives us, so far as that is concerned, every security on this head. As, however, the least infiltration of extraneous fluid into tissues so flexible and so easy to become disunited, as are those of the eyelid and orbit, might lead to purulent collections and dangerous inflammations, it appears to me more prudent that the wound should be left to suppurate. We are to dress it then loosely with a plumasseau besmeared with cerate, or, if there be hemorrhage, we use the perforated linen and balls of lint, and that for the first dressing only. It afterwards requires no other attention than ordinary simple wounds, and cicatrization is soon accomplished.

B. In a patient who suffered horrible pain in the orbit, from a wound of a lance in the forehead, M. Larrey (*Clin. Chir.*, t. I., ou Descot, *Op. cit.*) destroyed every symptom of tetanus by a division of the frontal nerve; and the same operation has succeeded, in one out of two cases, with M. Warren. Hennen and M. Guthrie, (*Archiv. Gén.*, t. XXV., p. 94; et Mackenzie, *Maladies des*

Yeux), who, following the recommendation of Beer, confine themselves to the simple section, have not succeeded; while, by uniting cauterization with it, M. Riberi (Bellinghieri, *Arch. Gén. de Méd.*, 2e série, t. VII., p. 209) was enabled to cure his patient.

§ II.—*Infra Orbital Nerve.*

This nerve being more deep-seated, surrounded with important parts, and spreading out like a fan upon its exit from the bones, is much less easy of excision than the preceding; it is also much less subject to neuralgia. Two modes may be followed to effect the object.

A. *By the Mouth.*—In prolonging upwards for the space of an inch the groove which unites the lip to the jaw, we traverse all the upper part of the canine fossa, and reach the root of the nerve, which is found in the direction of the first molar tooth, at the distance of three or four lines below the orbit. The bistoury, which should be used at first, should now, for the last stage of the operation, be replaced by the straight scissors. The principal advantage of this method, which was practised by M. Richerand, and who went to the extent of scraping the bone with his instrument, is that of leaving no mark on the face; but it has the disadvantage of allowing only of a simple section of the nerve, when in fact it would be desirable to excise it.

B. *By the Face*, the instrument divides, from the skin to the bones, all the soft parts which compose the cheek; and it is this, undeniably, which makes it more objectionable, at least among persons of the female sex. Fortunately, however, by following the natural furrows of the face, in the place of adhering exclusively, as M. Langenbeck (*Biblioth. de Chirurgie, ou Nosolog. und Therap.*) advises, to the direction of the fleshy fibres, it is in our power to obtain a cicatrix which will scarcely be observable.

I. *Operative Process.*—The patient should be seated, and arranged, and supported as for all other operations performed upon the face. Armed with a straight bistoury and placed in front, the surgeon makes at the bottom of the *naso-jugal* furrow, that is, from the groove or a line which extends obliquely from the ala of the nose to the middle of the space which separates the prominence of the cheek (pommette) from the corresponding labial angle; he makes, I say, in this direction, an incision an inch and a half in length, commencing at the outer side of the ascending process of the maxillary bone; he divides at first the skin only, and soon after meets the facial vein, which he pushes aside outwardly; he then comes to fatty tissue; then to the levator labii superioris, which he pushes backwards and inwards; then the levator anguli oris, under the inner border of which the nerve often lies concealed, now makes its appearance. To enable the operator to separate all these different parts, he must use a steel grooved sound, without any cul-de-sac. Detaching the filaments or tissues which still conceal or may conceal the nerve affected, he finally divides it very near the

infra orbital foramen, and excises a portion of it, which finishes the operation.

II. M. Warren, who has performed this operation twice, succeeded but in one case. M. A. Bérard, (Godin, *Journal des Conn. Méd.-Chir.*, t. III., p. 442,) who thought the T incision preferable, did not, however, succeed with it in the case of neuralgia in which he employed it; while M. André, (Hamel, *Thèses*, in 8vo, t. XXV.,) for a case of old infra-orbital neuralgia in a lady who fell under his care, was obliged to resort to deep cauterization.

§ III.—*Superior Dental Nerve.*

Being derived from the second branch of the fifth pair, the nerves of the upper dental arcade forbid the division of their trunk, when they become the seat of neuralgic pain; but it is sometimes practicable to attack them at the source of the disease. M. C., from the neighborhood of Cusset, was recommended to me in 1835, by M. Giraudet, now a practitioner at Tours. For fifteen years this patient had suffered from pains in the right side of his face, which nothing could assuage. These pains commenced in the spot which is usually occupied by the last molar tooth. In passing my finger on this region, I thought I perceived a slight granulation, which, when touched, immediately caused a violent access of suffering. There existed a possibility of obtaining relief by excising the region thus touched. By means of a pair of long, cutting nippers, curved suddenly and nearly at right angles on the borders near their cutting extremity, I embraced the whole posterior extremity of the margin of the jaw, and removed it at a single stroke. The pains were soon assuaged, and a year afterwards I received from M. Giraudet a letter, announcing the entire cure of our patient.

§ IV.—*Inferior Dental Nerve.*

The inferior maxillary nerve emerges from the jaw by the foramen mentale under the boney groove which separates the alveolar processes from the canine tooth and the first molar.

A. *Process of the Author.*—Nothing is more easy than to reach it at this point. While with one hand the surgeon reverses the lip outward and backward, he incises by means of a straight bistoury in the other, layer after layer and from above downwards, the tissues which are found at the bottom of the maxillo-labial groove. The teeth just mentioned will be his guide. In a short time, that is, at some lines in depth, he encounters the nerve, and isolates it to the extent of a quarter of an inch, by removing from the jaw the posterior portion of the soft parts which cover it, and then excises it in the same manner as has been said of the frontal nerve, and makes use of no dressing afterwards.

B. The *bleeding* however is quite troublesome by this process, for which reason M. Bérard (Godin, *Jour. des Conn. Méd. Chir.*, t. III., p.

442) preferred making a T incision reversed, laying open the whole depth of the tissues on the side of the chin; it appears, also, that the patient operated upon by this surgeon was perfectly cured. To apply the red-hot iron to the skin opposite the mental foramen, as Museux (*Bull. de la Fac. de Méd.*, t. I.) declares he has done with success, or immediately to destroy the nerve with caustic potash, as André (Hamel, *Oper. cit.*) did successfully in a man upon whom Maréchal had unavailingly performed the section of the dental (maxillo-dentaire) nerve, would neither be as simple nor as certain as this kind of excision.

C. When the neuralgia is seated at a greater depth, M. Warren (*Journal des Progrès*, t. XII., p. 270) has no apprehension of attacking the trunk of the maxillary nerve itself, and excising a portion of it in front of the pterygoid muscles. A crucial excision of the skin, the parotid gland, and masseter muscle, enabled him to apply the crown of a trephine upon the coronoid process, and by means of a probe to raise up the nerve above the dental canal, and excise about three lines of it with the scissors. The accompanying artery was wounded and tied without difficulty. The patient, who had been only temporarily relieved, but not cured by other excisions, and who suffered excessive pains, ceased to be troubled immediately after the operation, and has continued ever since in excellent health.

On the dead body this operation is not very difficult. In making trial of it, I have found it would be better to incise the parts in a semicircular and oblique direction from the lobule of the ear to the border of the jaw and front of the masseter, which latter it would be advisable to divide, and to raise up its fibres from behind forward; the trephine, applied upon the base of the coronoid process on a line with the sigmoid notch, falls exactly upon the nerve, and may even be made to divide it with the same stroke.

D. If the neuralgia were seated in a single tooth, we might, after the plan of M. Fattori, (*Rév. Méd.*, 1825, t. I., p. 294.) trephine the side of the alveolar process, and thus destroy the filament of nerve which is implicated. But the excision of the part in such cases is at the same time more certain and more expeditious.

§ V. *Facial Nerve.*

The portio dura of the seventh pair, spreading out as it does, upon almost every point of the visage, would naturally, at first sight, be supposed to be more frequently the seat of facial neuralgia than the other nerves, and consequently it is the one which has been often frequently excised.

A. Its *temporal-facial* branch, the only one which surgery has ventured to attack, crosses the neck of the condyle of the jaw at the point where the lobe of the ear unites to the integuments of the face. It is in this place that we should lay it bare. An incision, slightly oblique, is made from before backwards or almost vertical, which commences at the zygomatic process, and terminates on the

posterior border of the jaw above its angle. We have to divide successively the cellulo-adipose tissue, an aponeurotic layer and some slight prolongations of the parotid gland, before finding the nerve, which is separated from the bone only by lamellar and filamentous cellular tissue. By this method we are sure to avoid the temporal artery; and should the transverse facial artery be wounded, its compression would be too easy to make the hemorrhage from it cause any disquietude.

B. The other, the *cervico-facial* branch, being lost, as it were, in the parotid, presents too many anomalies in its position, while the trunk itself of the facial has been considered too deep-seated, and surrounded with parts too important to think of excising these nerves. We may, as I think, without rashness, appeal from this decision.

C. I have often ascertained on the dead body that the *trunk* of the facial nerve could be laid bare without danger at its exit from the cranium and before it has furnished other branches than the filaments of the mastoid, digastric, and stylo-hyoid. For that purpose, the operator has only to make a vertical incision an inch and a half long between the mastoid process and the lobe of the ear; then in coming down to (*en rasant*) the anterior face of the osseous projection and the corresponding edge of the sterno-mastoid muscle, a depth of 6 to 10 lines, he has to divide, layer by layer, the teguments, the cellular tissue, and the parotid gland, which latter is to be turned forward. The lips being drawn apart, we perceive the nerve at the bottom of the wound, nearly in the middle of the space which separates the temporo-maxillary articulation from the apex (*sommet*) of the mastoid process, and where it seems to take a direction towards the border of the inferior maxillary bone. The division and even the excision of it is then in every respect as simple and easy as that of the frontal, and it is clear that this section, in itself, presents all the security desirable under such circumstances, if it be true also that these different excisions of the nerves are, in fact, the actual remedy for facial neuralgia. I purposely suggest some doubts as to these excisions, because the facts yet ascertained are not sufficiently conclusive in their favor. If, in some cases, they have been followed by a marked diminution, or even the entire subsidence of the pains, we have much more frequently observed that they procured no relief, or assuaged the anguish but momentarily. I have mentioned the case of a man who was subjected to all these operations on both sides of the face, and without experiencing any appreciable advantage from them. M. Warren had a patient, in whom, after the excision successively, of the frontal, infra-orbital, and facial nerves, only temporary relief was obtained. Boyer communicated to me a similar observation. The patient in whom he excised successively the four principal nerves of the face, though at first slightly relieved, was no more cured than the one of whom I have spoken. Moreover, if it be true that the frontal, infra-orbital and mental nerves, in fact, that all the branches of the fifth pair are exclusively nerves of sensation, (sen-

sitive,) while the seventh pair is alone charged with the office of presiding over the muscular movements of the face, then is it evident that the section of this last can have no other effect than to paralyze the muscles of the face, while to the other three only, must our attention be directed in whatever concerns neuralgia.

ARTICLE III.—NERVES OF THE NECK.

Up to the present time I believe no one has undertaken the section or excision of the nerves of the neck. M. H. Bérard however has related to me the case of a woman who suffered so severely in the sterno-mastoid or carotid region, that she earnestly entreated that some operation might be performed which might relieve her of her distress; a small deep-seated tumor was perceptible which appeared to be situated upon the pneumo-gastric nerve. This woman, however, died I believe without having had anything done for her. Having also myself observed a nervous tumor in the same region, and which appeared to belong to the great sympathetic nerve, I shall, in treating of operations applicable to tumors, describe the process which is to be followed to enable us to reach down to these nerves. I may make the same remark in regard to what concerns the section of the nerves of the thorax.

[*Division of the Par Vagus on one side without causing death, and followed by recovery.*—I understand that very recently and within a few months, Dr. McClellan, an eminent surgeon of Philadelphia, in removing an enlarged parotid gland from below the angle of the jaw, and which had extended to some distance down into the neck, was obliged, from the par vagum on that side being embedded in the tumor, to exsect and actually *take away about two inches of this important nerve* without producing apparently much inconvenience to the respiratory or other functions. Finding such an unprecedented result from the exsection of so important a nerve, which, as far as we are informed, had never before been interfered with on the human subject, but on the contrary always avoided with extreme caution; the surgeon designedly left the wound open for some days, in order that other surgeons of Philadelphia might satisfy themselves, by inspecting it, of the truth of what had occurred. The fact is thus placed beyond dispute, that all the vital functions of this important pair of nerves may in living man be performed by *one nerve alone*, which could have scarcely been anticipated from the pathological and physiological views hitherto entertained.

It is true that experiments on quadrupeds had satisfactorily established the fact that life may be sustained even after division of one of the par vagum; but never before was this fact proved, we believe, on living man, until accidentally ascertained, as we have above described, by the surgeon of Philadelphia.

Nevertheless Dr. Mott has always scrupulously avoided wounding or dividing this nerve in all his surgical operations; and is satisfied that such ought to be the rule in every case where it is pos-

sible so to do, notwithstanding the pathological fact established by Dr. McClellan. In this case of Dr. McClellan, he thinks the functions of the nerve, on the diseased side, may have been interrupted, or to a certain extent annihilated, before the operation was performed. Its situation in the tumor in which it was imprisoned and compressed, warrants this inference. T.]

CHAPTER II.

NERVES OF THE LIMBS.

ARTICLE I.—NERVES OF THE THORACIC EXTREMITIES.

§ I.—*The Fore-arm.*

We may have occasion in the arm to make the division of the radial, ulnar, or cutaneous nerves, and even that of the median nerve.

A. *Ulnar Nerve* (nerf cubital.) In 1832 Lauth wrote me that he had practised the excision of the ulnar nerve three times in epileptic patients; the operation succeeded in one of the cases, but failed in the two others. The paroxysms in the first case were ushered in by an *aura epileptica*, while in the others this did not occur. If we wish to repeat this operation, whatever may be the indication, the limb should be placed in the same position as for tying the arteries. The parts would be incised in the same place and in the same manner as for this last operation. After having divided the integuments and a first aponeurotic layer, then pushed to the inner side the flexor carpi ulnaris, and divided a second fibrous layer, we should find the nerve in the form of a white cord within and a little behind the artery. After having isolated and raised it, we should excise from it a fragment of at least from two to four lines in length. If we should limit ourselves to dividing it transversely, its two ends would soon reunite and there would be nothing to hope from the operation. In a case thus treated by M. Cairoli, (*Arch. Gén. de Méd.*, 2 sér., p. 137,) Professor Viviani saw the neuralgia reappear at the expiration of a few days. In the case of a gardener, noticed by A. Dubois, (*Descot, Affections Locales des Nerfs*, 1825,) and who had the ulnar nerve above the wrist divided by the cut of a pruning knife, the paralysis lasted but a very short time. Excision more formidable than the division as respects the paralysis which it should seem it ought to produce in the third or fourth fingers, has not, however, been always followed by it. A young man had in this manner a portion of his ulnar nerve and the corresponding artery destroyed above the wrist by an accident. A paralysis which continued for six weeks in the

two fingers, mentioned, afterwards gradually disappeared. When I saw the young man again, a year after, he felt nothing more of it.

B. *Radial nerve.* Among the examples of the section of the radial nerve, there is one related by M. A. Cooper, (*Arch. Gén. de Méd.*, 1838, t. II., p. 183,) in which the operation was performed for a neuralgia caused by a contusion of the thumb, and attended with success. A similar fact is related by M. Wilson, (*Swan, Maladies des Nerfs*, p. 117.) M. Teewan, another English surgeon, (*Arch. Gén. de Méd.*, loc. cit.,) has been equally successful in ordinary cases of neuralgia. But it was a cutaneous nerve and not the radial which M. Wilson divided.

The operation in such cases exacts precisely the same precautions as in the ligature upon the radial artery. Except that the incision should be made outside of the track of the artery, since the nerve is found nearly in the middle of the space which separates the outer edge of the radius from the course of the vessel.

As the radial nerve is of infinitely less importance than the ulnar, we might without any apprehension, excise a long portion of it. In a young lady who was exhausted by the pain, A. Petit (*Verpinet, Journal de Méd.*, t. X.; Descot, p. 18) effected a complete cure in his patient by producing a large eschar by means of the hot iron applied upon a cicatrix which included the radial nerve.

§ II.—*The Elbow.*

The nerves which lie in the neighborhood of the veins in the bend of the arm, have been so frequently charged with causing severe accidents resulting from bleeding, that early attention was directed to the subject of their division. It is an operation, however, which has not been subjected to any surgical rule, and one which was no longer thought of until M. Hamilton (*Arch. Gén. de Méd.*, 1838, t. II., p. 174) again drew public attention to it in 1837.

A. *The Cutaneous Nerves.*—The section of the cutaneous nerves has been performed by M. Watson, M. Sherwin, and also by M. Wilson to remedy accidents from bleeding. M. Crampton, however, in dividing for this purpose the cutaneous nerve in a young lady obtained only an imperfect cure.

I. Upon the supposition that we were not disposed to operate upon the point whence the pain originated, we might find the external cutaneous or musculo-cutaneous nerve above the fold of the arm between the biceps and the anterior border of the supinator radii longus, (long supinateur.) An incision, two inches in length, slightly oblique from above downwards, and from behind forwards, would, after having divided the skin, sub-cutaneous fascia, and aponeurosis, necessarily conduct to this nerve, after reaching which we should excise a portion of sufficient length.

II. For the internal cutaneous (cutané interne) nerve, the incision would require a little more caution on account of the neighborhood of the artery. Carried obliquely from the middle of the

lower part of the biceps to an inch below the internal condyle of the humerus, it should not go below the aponeurosis, since the internal cutaneous (cutané interne) nerve is invariably situated at this point in the thickness of the sub-cutaneous layer near the median, ulnar and basilic veins. [See a note of Dr. Mott on wounds of the cutaneous nerves in bleeding and the operation, Vol. I.]

III. *The Ulnar Nerve*, (nerf cubital.)—Many of the nerves of the arm have long been submitted to the operation of excision; the ulnar (cubital) alone, however, as it appears to me, has had this operation performed upon it at a prescribed point of its track. The operation was performed by Delpech (*Révue Méd.*, 1832, t. I., p. 80) in a lady who for a long time had suffered from a neuralgia which appeared to proceed from an ulcerous affection of the wrist. Holding the arm in such a manner as to turn the elbow forward, Delpech made an incision an inch and a half in length, between the olecranon and the inner condyle, (epitrochlée,) over the immediate track of the ulnar (cubital) nerve. This nerve was soon exposed to view, then divided on its upper part, and a portion excised. The pains immediately subsided, and ultimately disappeared. The complete paralysis which at first took place, became reduced to a slight numbness of the third and fourth fingers, which, however, retained all their mobility.

If the excision of the radial (nerf radial) and the median (median) has been performed upon the continuity of the arm, as M. Richius supposes, it has been in the case of tumors, of which I shall speak further on, and not for neuralgia. As it is the tumor which serves as the guide in such cases, I have not to discuss that subject in this place. The case related by M. Larrey belongs rather to the cutaneous nerves than to the radial (radial.)

ARTICLE II.—THE NERVES OF THE LOWER EXTREMITY.

The excision of the *nerves of the foot*, unless they should be the seat of some nodosity or tumor, could not be subjected to any fixed rules as regards a surgical operation. The case is different, however, with the nerves of the leg or thigh.

§ I.—*Nerves of the Leg.*

There are four nerves of the leg which may be cut down to, and divided by the surgeon, viz.:—the internal saphena, (saphène interne,) the external saphena, (saphène externe,) the anterior tibial, (tibial antérieur,) and the posterior tibial, (tibial postérieur.)

A. *The Internal Saphena*, (saphène interne.)—If the internal saphena should be the seat of violent and obstinate pains, as in two patients in whom Sabatier was disposed to employ cauterization, nothing would be more easy than to excise a portion of it. We should do this on the point itself from whence the suffering appeared to proceed, as, for example, where a cicatrix or ancient lesion of the tissues was found on the leg. If not, we should seek for the

nerve above the parts where the pains usually existed. We might reach the nerve by means of an incision an inch or two inches in length made upon the track of the vein of the same name. The nerve is almost constantly found upon the posterior face of this vessel. Nor would there be any serious inconvenience in excising with the same stroke the vein as well as the nerve, if the surgeon should meet with any difficulty in distinguishing the former. Only it would be necessary in that case to apply a ligature upon the lower end of the vein, if the wound was to be closed by first intention. It is unnecessary to add that this nerve, both on the foot and as high as above the knee, follows, as in the leg, the course of the vein.

B. *The External Saphena* (saphène externe.)—In supposing that the suffering should be confined to the outer part of the foot, or the lower third of the leg, it would be practicable to excise the external saphena after the same rules which I have laid down for the internal saphena, that is, it would suffice to incise the integuments on the track of the vein bearing the same name, towards the fibular border of the foot behind the corresponding malleolus or outside of the tendo Achillis. Higher up we would not arrive at it with any certainty, except by making an oblique or transverse incision about two inches long on the outer and lower side of the calf. Cutting down to the aponeurosis, we should be enabled to recognize its trunk, the two roots of which unite a little higher up.

C. *Anterior Tibial Nerve*, (poplitée externe, ou tibial antérieur.)—This nerve, supplying all the dorsal region of the foot, and traversing the whole anterior portion of the leg, may be attacked with neuralgia, or pains sufficiently acute to suggest the idea of dividing it or excising a portion of it. Nicod (*Journ. de Méd.*, Nov. 1818) says that the nervous accidents caused by this nerve becoming compressed between the fragments of bone in a fracture of the leg, caused the death of the patient. The operation, besides, being attended with a good deal of difficulty upon the instep and the whole anterior part of the leg, would not be entirely free from danger.

I would, therefore, recommend it to be performed below and behind the head of the fibula, where the nerve loses the name of the external popliteal. The limb, slightly flexed, should be turned upon its inner side. An incision, carried from the termination of the popliteal space to the beginning of the anterior inter-osseous fossa of the leg, so as to follow the groove which separates the tendon of the biceps muscle from the root of the gastrocnemius externus, then to cross the external and anterior surface of the fibula immediately below the head of this bone, would perfectly fulfil our intention. To arrive at the nerve, the surgeon would thus have to divide successively the skin, sub-cutaneous fascia and aponeurosis; separating the tissues apart by means of a sound, he would then discover the nervous cord between the gastrocnemius externus, which lies within and below, the tendon of the biceps, which is found above

and outside with the head of the fibula, and the posterior border of this bone, or of the peroneus longus muscle which is seen in front.

In case of difficulty, we might without danger cut down to the bone through the whole thickness of the peroneus itself, so that in searching from the head of the bone to eight or ten lines below, it would be impossible not to find the nerve. After raising it up on a grooved sound or an erigne, it should be excised in the same manner as we have said of others. Its excision at this point would have probably saved the patient of Nicod. Certain it is, that the patient operated upon in this manner by M. Yvan, (*Des-cot, Thèse No. 233, p. 43, Paris, 1822,*) was promptly and radically cured of an ancient neuralgia of the leg.

D. *Posterior Tibial Nerve*, (nerf tibial postérieur.)—The excision of this nerve could not be performed without real danger, except between the termination of the calf and the beginning of the plantar surface of the foot; and it is behind the internal malleolus that the operation would be most practicable, or the least dangerous. The leg is to be placed in demi-flexion on its outer side. The surgeon divides through the integuments, sub-cutaneous fascia, and aponeurosis, at about six lines behind the posterior border of the internal malleolus, and to the extent of two inches and parallel to the axis of the limb, in the same manner as for cutting down upon the posterior tibial artery. Situated behind and outside of this artery, and in the midst of a loose cellulo-adipose tissue, this nerve is recognized by its yellow color and its size and cord like appearance. The absence of pulsation, and the difficulty of compressing it, enable us, moreover, to distinguish it from the vessel. Having raised it upon a sound, or secured it with an erigne, we should excise a portion of it with strong scissors, in the manner already described.

In performing this operation, Delpech (*Lancette Francaise*, t. V., p. 457-458; *Rev. Méd.*, 1832, t. I., p. 72) made his incision too near the edge of the bone; but the skill of the operator easily triumphed over this difficulty. It appears that the patient recovered perfectly. A fact to be noticed here is, that the foot, at first benumbed and almost insensible, finally regained to a great degree its faculty of motion and feeling. It results, therefore, from this, that the excision of the anterior tibial nerve (tibial antérieur) would not probably cause a permanent paralysis of the extensor muscles of the toes, the loss of the movements of extension, and the establishment of a pes equinus, as was at first imagined.

As to the section of the saphena nerves, it could only interfere with the sensibility of the integuments, and this, it might be hoped, would not be of long duration.

§ II.—Nerves of the Thigh.

Among the nerves of the thigh, there are scarcely any other than the great sciatic whose excision could be attempted.

A. I have however read, in a volume recently published, that a surgeon, not content with having divided the sciatic nerve for a neuralgia of the leg, tried also to make the section of the femoral nerve; but it was found, after death, that he had missed it. To say that the division of the femoral nerve in the thigh ought not to be attempted, would be entirely unnecessary, since, as all anatomists know, it divides itself into an infinity of branches, immediately upon its arrival at the groin.

B. As to the *sciatic nerve*, it is of so large a size, and it nourishes of itself so great an extent of parts, that the very idea of its excision, or even of its simple division, has in it something frightful. The sufferings from the sciatic have, on the other hand, a character so violent and of such obstinacy in certain patients, that one would be almost tempted to make trial of anything to put an end to them. We must, therefore, not be too much astonished to learn that the excision of this nerve has actually been performed, and that a surgeon of Italy has had the courage to recommend it.

It was in 1828 that M. Malagodi (*Arch. Gén. de Méd.*, 2e série, t. VI., p. 114) had recourse to this operation for the cure of a neuralgia which nothing had been able to relieve. The limb was placed as in the operation for a ligature upon the popliteal artery; the surgeon then made a long incision, from the middle third of the thigh to the hollow of the ham. Dividing through the integuments, sub-cutaneous fascia, and aponeurosis, he soon came between the biceps muscle, which is found upon the outside, and the semi-membranosus, which is situated upon the inner side. Continuing to divide the tissues layer by layer, and then substituting the end of the sound for the bistoury, he soon reached the nerve, in the form of a large cord of a slightly yellowish color.

The uppermost part of the region of the ham should be preferred in such cases: 1st. Because in this place the two branches of the sciatic, if it be that they have already separated, are still in close approximation to each other; 2d. Because the popliteal vein and artery, besides being always deeper and situated more within, are here much farther distant from the nerve than in the hollow of the ham itself.

After having properly isolated the sciatic nerve and passed his finger underneath, M. Malagodi performed the section of it in the upper angle of the wound. Numerous accidents ensued. The wound was five months cicatrizing; the limb, at first completely paralyzed, was a long time in recovering its sensibility; but it finally regained its functions, and the patient was, as we are told, perfectly cured at the expiration of a year.

I should not wish that this account would induce others to undertake such an operation, unless in a case of necessity; nor would I even assert that it could ever be indispensable; I would remark, only, that the case related by M. Malagodi ought to be registered and that the question merits the investigation of surgeons.

ARTICLE III.—EXCISION OF THE EXTREMITY OF THE NERVOUS TRUNKS AT THE BOTTOM OF ANCIENT WOUNDS OR CICA-TRICES.

We find, among those who have been amputated or wounded, patients who complain of excruciating pains when any one touches their scars, or the end of the stump. The observations of M. Larrey have shown that the nerves, after amputations, in becoming agglutinated together or adherent to the cicatrix itself, are liable to tumefaction and a peculiar change at their extremities. In these cases, the constancy (la fixité) of the pains and their circumscribed extent, and the manner in which they are propagated, induce us to suppose that the excision of the parts might be calculated, in some cases, to afford relief. It is an operation, however, which has hitherto never yet been attempted, and which it would be difficult, moreover, to arrange under any established rule of operative surgery. M. Champion, who was tempted to undertake it upon the sciatic nerve, for an obstinate neuralgia in the stump of a thigh which he had amputated, finally gave it up. M. Palmer (*Encyclograph. Méd.*, 1836, p. 41) had a case of convulsions and agonizing pains in the stump after amputation, but the excision of an inch of the fibular nerve, which protruded from the cicatrix in a state of hypertrophy, afforded but partial relief. I have no other instance at present to cite in favor of this operation.

[EXSECTION OF THE MEDIAN NERVE, &c.

This was first performed in America by Dr. Mott. Dr. Darling, demonstrator of Anatomy at the University of New York, suggests to us a mode of reaching the median nerve which, as far as we are acquainted, is not laid down in any surgical work. It is this:—

“An incision, from an inch and a half to two inches in length should be made along the ulnar border of the tendon of the palmaris longus muscle, a little above its insertion into the annular ligament. The integument, superficial fascia, and aponeurosis of the fore-arm being successively divided, the median nerve will be brought into view, situated behind, and rather towards the ulnar border of the tendon, where it may be readily distinguished from the tendons of the flexor sublimis, by its whiteness, or by pinching it with a forceps, when great pain will be experienced in the thumb, the index, and middle fingers. If the hand be now slightly flexed on the fore-arm, the palmaris longus may be pushed to the radial side, and a portion of the nerve be easily exsected. It is perhaps unnecessary to add, that the upper section must be made first.

In cases where the palmaris longus is wanting, the nerve can readily be exposed by making the incision three-eighths of an inch from the ulnar side of the tendon of the flexor carpi radialis.” This is certainly far preferable to, and much safer than dividing

the trunk of this nerve, high up in the arm, upon the inner side of the biceps flexor cubiti muscle.

Electro-Puncture in Neuralgia.—M. E. Hermel, (*Annales Médico-Psychologiques*, Paris, Janv., Mars & Mai, 1844.—*Journ. des Connaiss.*, Paris, Juillet, 1844, p. 27—8,) as an evidence of the successes which electro-puncture has had in his hands, in the treatment of some of the severest forms of neuralgia, almost all of them lumbo-sacral and sciatic, accompanied in some instances with partial paralysis, gives eight cases in which perfect cures were speedily effected by electro-puncture, when all the usual modes of depletion, purgation, &c., were of no avail.

He says nothing, however, of the still more formidable and distressing forms of neuralgia, known as *tie-dououreux*. Nevertheless, he is inspired with full confidence in the value of this remedy, and while he promises to supply fresh evidence thereof, meanwhile comes to these conclusions :—1, That electro-puncture is applicable to idiopathic or essential neuralgias ; 2, The violence of the pains is not a counter-indication to the employ of this therapeutic agent ; they have never in any case been aggravated by its use ; 3, The paralysis which supervenes in the progress of idiopathie (essentielles) neuralgias, yields to the same treatment.

Inutility of Exsection for Neuralgia.—M. Bérard, has seen (Malgaigne's *Manuel de Méd. Opérat.*, 4th edit., Paris, 1843, p. 150,) an *infra-orbital* neuralgia, return after having excised *three inches* (nine millimetres) of the nerve, and Swan has seen the two ends of a nerve in a horse reunite, (Ib.,) after having excised a segment near *nine inches* long !

M. Malgaigne suggests, (Ib.,) whether it might not be advisable after dividing the nerve to detach both ends by dissection, and fold them back on the trunk so as to form a noose, or to interpose between the ends a small fleshy flap from the immediate neighborhood, the better to interrupt, when the electrization is completed over this, the continuity of nervous influence.

M. Bonnet of Lyon, proposes in the frontal nerve to divide it freely down to the bone by a sub-cutaneous incision, (Ib., 151—152.)

M. Malgaigne, for the *infra-orbital* nerve, prefers also the sub-cutaneous section on the groove of the nerve in the floor of the orbit, after which he tears out the divided fragment from its groove by means of a forceps, applied to the portion of the nerve laid bare, and divided a little below the orbit, (Ib., p. 153.) M. Bonnet makes only a sub-cutaneous division of the nerve, (Ib.)

Amputation of the Fingers and Arm, for Concussion of the Nerves of Sense.—Amputation has been had recourse to, but without any benefit whatever, in cases for example, where the *little finger* from a mere blow, has without any external lesion been followed by severe neuralgic pain, and finally wasted away. Dr. Wigan, in a case of this kind in a lady who struck her little finger against a garden roller, amputated it, but finding the distress continue in two others, amputated them also, with a like unsuccessful result. Neuralgic pain in every part of the body came on, and the patient died

a martyr, (Proceedings of the Medical Society of London, March, 1845.—London Lancet, May 3, 1845, p. 505.) Mr. Crisp proposes in such cases, (Ib., loc. cit.,) the possible advantage of removing a certain portion of the nerve, from the remarkable effect known from this kind of operation on the lame foot of horses.

According to Mr. Pilcher, (Ib., loc. cit.,) the nerves of the organs of sense, as of the eye, may become paralytic by pure *concussion*, i. e., by a blow without any ecchymosis or change of structure. M. Dendy, however, (Ib., loc. cit.,) has known a family, the members of which were so delicate, that slight pressure on the surface produced a kind of thrombus. It is difficult to determine, however, how far neuralgic and paralytic diseases of the nerves are dependent on the influence of the nervous centres, or on local causes. Surgery in most such cases seems to have less resources than internal constitutional treatment, and external applications.

Remarkable Ganglionic Transformation of the Nerves.—M. Serres of Montpellier, communicated to the Academy of Sciences of Paris, April 3, 1843, (See *Journ. des Connaiss.*, &c., de Paris, Mai, 1843, p. 216,) the results of observations made by him upon a remarkable ganglionic transformation of the nerves of organic and animal life in two young men examined after death, one shown to him by M. Manec, at Salpêtrière, in 1829, the other recently by Drs. Petit and Sappey. Both had died of typhoid (*entero-mésentérique*, improperly so called by French writers) fever. All the nerves of the limbs, and face, and the intercostals and lumbar nerves, were occupied in their course by numerous *ganglionic enlargements* (*renflemens ganglionnaires*) of the form and external physical characters of the superior cervical ganglion. The posterior branches of the spinal nerves were affected with this transformation to the same degree as the anterior branches; while the nervous branches of communication between these abnormal enlargements appeared to the naked eye to be unaffected. The number of these ganglions was less on the nervous filaments of the great sympathetic, than on those of the nerves of relation of life; but nevertheless, so considerable as to entirely change its aspect. The nerves that form the lumbar and sacral plexuses, the great sciatic nerves, and the two pneumo-gastric, were those upon which this transformation was the most extensively developed. For example, the *great sciatic nerves*, in their course through the upper part of the thighs, (le long de la partie supérieure des cuisses,) had acquired the *size of the humerus*, (le volume de l'humerus,) and their external surface was completely embossed by the inequality in the size of the abnormal enlargements.

In neither case did the structure of the cerebro-spinal axis, present any trace of alteration; which, says M. Serres, is another argument against the opinion of Gall that the spinal marrow of man and vetebrated animals is of a ganglionic structure. Dr. Petit adds that the groove on the inner border of the ribs, for the passage of the intercostal vessels and nerves, was increased in width and depth; produced doubtless by the ganglionic enlargement of the intercos-

tal nerves, and which, as well as the inequality of development of these abnormal ganglions generally, seemed to show that the degeneration had been a long time in progression.

Nervous Substitutions.—At the sitting of the Academy of Sciences, of Paris, Jan. 6, 1845, (*Gaz. Méd. de Paris*, Janv. 11, 1845, p. 28,) Dr. Taignot, in a communication on the subject of “substitutions veineuses,” remarks that considering it now to be established by a great number of experiments, that when a nerve is divided, and its two cut extremities are placed in juxtaposition, it recovers its continuity, and re-acquires its functions, he asked himself the question, if what took place between the two extremities of the same nerve, would not equally happen between the extremities of different nerves when placed in juxtaposition; to solve which problem, he undertook a series of experiments, by which he established the following facts:—

1. If two neighboring nerves are included in the same ligature, with the view of dividing them both at the same time, there is developed between their four cut extremities a sort of nerve-like ganglion, (*ganglion nerviforme*,) which is common to them, and in which the fibres of the two nerves and their functions appear to be blended;

2. If the section of two nerves that are separated but a short distance apart, is made in such a manner, that the upper extremity of one is placed in contact with the lower extremity of the other, the result is the formation of a nerve which preserves its functions entire.

The practicability of thus *engrafting one nerve upon another* being established, a route is opened for new experiments calculated to give greater elucidation to the physiology of the nervous system.

The fact had already been established in respect to the practicability of uniting, or engrafting by suture, the cut extremities of an extensor tendon of the middle finger to those of the adjoining fingers, which last thus served to execute the movements required of the wounded finger, (See Vol. I., p. 409, 410, &c. ;) but we are not aware to what object of practical utility, so far as a new direction to, or channel for, the distribution of the nervous fluid, either in neuralgia or any other disease, this engrafting of nerves could be applied. It seems to be evident that in neuralgic affections, as of the face, at least, which often involve so great an extent of nervous distribution, the grafting of two adjoining nerves in the manner described, could not afford any relief to the disease.

It appears that at the same meeting of the Academy of Sciences, (*Gaz. Méd. de Paris*, Jan. 18, 1845, p. 46,) that M. Flourens claimed priority of Dr. Taignot, on the subject of engrafting nerves, having made and published many years since a series of experiments similar in every respect, as to their character and results, to those of M. Taignot. He has thus seen effected the union of many nerves crosswise, (*réunion croisée*,) for example, that of the superior with the inferior nerves, of the brachial plexus, and even that of the cervical nerves with those of the pneumo-gastric. In

every case the *union was complete*, and in some of them there was a perfect restoration of the functions, (Vid. *Mémoires de l'Académie des Sciences*, Paris, Tome XIII., p. 14, et suiv., and the work of M. Flourens, entitled, *Recherches Experimentales sur les Fonctions du Système Nerveux*, &c., p. 272, et suiv.)

Influence of the Sympathetic.—Dr. Procter, in a late memoir, (*Medico-Chirurgical Review*, Jan., 1845, p. 112,) emboldened by the remarkable discoveries of the motor, excitor, and respiratory systems of nerves, those of Dr. M. Hall on reflex-action, and on the direct power of the medulla oblongata and medulla spinalis over the sphincters and muscles of the body, and those of Flourens and Philip, on the non-dependence of the circulation upon the cerebro-spinal system, advances the novel and ingenious doctrine that the immediate duty and office of the great sympathetic and its branches is to regulate the contractility of the blood-vessels. Dr. Procter alludes to the important fact that though nerves from other sources frequently accompany arteries for a long portion of their course, they never transmit either large or small branches to them, so that their juxtaposition must be referred to some other cause than for affording facility for influencing their movements. While on the contrary, the *sympathetic is emphatically* the nerve of these vessels, enmeshing and penetrating them on every side, and following their minutest ramifications to their ultimate distribution. Hence, says Dr. Procter, in those great systems of organs, or great organs in which large and *sudden supplies of blood are required*, as the heart, stomach, bowels, and organs of generation, we have the ganglionic or sympathetic system very fully developed, and in *a ratio, he thinks*, to the amount of blood supplied to the different organs. On the contrary, where a reverse condition of things exist, as in the extremities, this nerve decreases in size, and in fact often appears to be wanting. He points out also as indicative of peculiarity of function, the remarkable difference in the ganglia of the sympathetic and those of the spinal nerves. In the former, the ganglia are oblong and smooth, and the nerves come out of them like elongations or tails; the spinal are globe-like and the nerves enter and leave them in bundles or fasciculi.

Dr. Procter rationally suggests, that in debility and exhaustion of those organs supplied by the sympathetic, the tonic, stimulating treatment, directed to the restoration of the nerves themselves, would be most efficient, instead of the prevailing depleting system generally pursued. He alludes, in confirmation of this, to the analogous beneficial results produced by strychnia and the electric or galvanic influence upon functional disorders in some of the organs over which the sympathetic, and that alone, has control. So the value of strychnine on paralysis, carbonate of iron in neuralgia, &c., may depend solely upon their direct action on the sympathetic and its distributions. T.]

SECTION IX.

AMPUTATION OF THE LIMBS.

PART FIRST.—AMPUTATION IN GENERAL.

AMPUTATIONS being the last resource of surgery, should not be performed but as a desperate remedy, (*en desespoir de cause.*) Always in itself a serious operation, it necessarily involves the mutilation of the patient. Nevertheless, in cases which seem to require it, the practitioner, without forgetting that the aim of surgery is to preserve, *not to destroy*, and that we acquire more honor in saving a limb than in skilfully performing *a great number of amputations*, ought not to keep out of view that it is better to sacrifice a part than to let the whole perish, and that patients prefer *life with three limbs than death with four*.

The necessity of sacrificing a portion or the totality of a limb must have been experienced at every epoch. It would seem, however, that in former times this operation was rarely undertaken. The Hippocratists give but few details on this subject, and Celsus is the first who has furnished us with a tolerably accurate description of this operation. The ancients, being but imperfectly acquainted with the circulation of the blood, and ignorant of the means of guarding against hemorrhage, must have had constantly before them the apprehension of a fatal termination as often as the question came up of taking off a limb of any considerable magnitude. On the other hand before the discovery of gun-powder, national wars being less destructive in their tendency, naturally rendered amputation less frequently necessary than it has become since. At this early period they confined themselves to the separation of the dead parts, without touching the living tissues, and this practice which was continued among the surgeons of the middle ages, is also recommended by Fabricius ab Aquapendente.

Though the ancients rarely speak of amputation except in cases of gangrene or corroding (*rongeants*) ulcers, we find, however, that they had at an early period become aware of the necessity of dividing the tissues above the mortified parts. Celsus (*De Re Med.*, lib. VII., cap. 33,) formally recommended it, and Archigenes of Apamea appears to have performed it frequently. Always alarmed at the idea of hemorrhage, they invented a thousand contrivances (at the present day forgotten,) by which they could prevent it, and thus made amputation an operation so terrible that many among them preferred abandoning their patient to certain death. Some commenced with securing the vessels by inserting a ligature through the whole thickness of the limb; others by strangulating the entire contour of the limb itself and sprinkling cold water upon it. The

operation being finished they burnt the surface of the stump with a red hot iron or with boiling oil.

Albucasis, less timid than the others, says :—" When we cannot preserve a limb we must cut it off as high up as the sound part (jusqu'au sain) since the death of the whole body is a greater evil than the abstraction of a limb." Guy (*Traict. 6, Doctr. I., chap. 8, p. 469*) advises that we should cut a little above the diseased tissues, "at the place where upon introducing the tent there shall be found a resisting texture and pain," (au lieu auquel on aura trouvé avec la tente introduite fermeté et douleur.) For that purpose the limb was first held firm by the assistants; the soft parts were then divided with a razor down to the bone; after which the lips of the wound were protected by a compress that they might not be injured by the saw; finally the surface of the stump was cauterized with red hot iron or boiling oil.

It is not certain, however, that this method was adopted by Guy de Chauliac, for he soon after adds :—" As for myself I envelop the whole mortified limb with a plaster, and I keep this on until the separation is complete, (la jointure soit fondue,) and that it falls off of itself; which is more humane in the physician than if he cut it off, for when it is cut off there always remains behind a grudge in the mind of the patient who thinks that it might have been preserved to him," (*Operat. cit., p. 466.*) It is doubtless this passage which has given rise to the idea that Guy strangled the limb or a bone on a line with the articulation by means of a ligature, in order to bring about its separation, an error which M. Dezeimeris (*Dict. de Méd., 2d ed., t. II., p. 479*) has established in the most conclusive manner.

Notwithstanding the efforts of Paré to induce the adoption of the ligature upon the vessels after amputations, Pigray, Dionis and Rossi, still prefer the actual cautery in certain cases; but this barbarous practice has long since been proscribed from surgery.

At the time of Hippocrates (*Op. cit., p. 466*) amputation of the limbs was most usually performed at the joints, (articles.) This practice prevailed also among the Arabs, for we are told in their works that if the disease (corruption) extends to the neighborhood of the joint, amputation must be performed at the joint itself by means of a razor or other instrument in place of the saw, (*Dict. de Méd., 2d ed., t. II., p. 479.*) The method of Celsus, though advocated by Gersdorf of Strasbourg, and by De Cervia a long time before, and by Maggi and some others afterwards, was however abandoned by most practitioners; insomuch so that in the seventeenth century Botal had the courage to eulogise a surgeon who was in the practice of placing the limb upon the cutting edge of a hatchet, fixed in a solid position, and then letting fall upon it from an elevated point another hatchet to which an additional weight was given by attaching to it pieces of lead. Finally, to set out from Ambrose Paré and Wiseman, the practice in this respect has entirely changed; since which time amputation of the limbs has become much less dangerous.

CHAPTER I.

INDICATIONS.

The cases that require amputation demand the most careful consideration, and will become, it is hoped, less and less numerous in proportion as the healing art advances, and the correct mode of treating diseases shall be more and more diffused.

ARTICLE I.—LIMBS ALMOST ENTIRELY DIVIDED.

If the limb is in great part separated from the body in consequence of the wound itself, the idea naturally suggests itself immediately of completing the amputation. It is important, however, not to decide upon it too precipitately; I have shown in the chapter on anaplasty, how many organs we have it in our power to restore, when there had been reason to suppose that their removal was indispensable.

In the case of the fingers when held only by a small strip of skin, and which reunite perfectly well, the question, as M. Champion says, has long since been put at rest by all practitioners. I have before me as many as thirty examples of this kind gathered from the practice of others, and I could augment the number by a dozen cases taken from my own, among which there was one in which from the contusion with which the wound was complicated, it was apprehended that the attempt at reunion would prove abortive.

Of all these facts the most curious is that related by Bagieu, (*Exam. de plus. Parties de la Chirurg.*, 1757, 2 vol., 12mo,) where a ring finger reunited with the nail turned round in front. The patient mentioned by Forestus, (*Bonet*, t. III., 140, liv. 2, obs. 51,) had had the whole hand divided with the exception of the outer and posterior portion. In that of Charrière, (*Gaz. de Santé*, 1780, No. 24, p. 95,) the four last bones of the metacarpus had been divided by the stroke of a hatchet, and were retained only by a small strip of skin near the thumb. In one of those of Bagieu, (*Op. cit.*, t. II., p. 596,) the wound went through the entire thickness of the two last metacarpal bones. Salmon (*De Artium Amputat. rar. admittenda*, § 19, sect. 2, 1777) relates cases in which the right fore-fingers had been bitten by an ass, and were nevertheless restored. Harbicht (*Bibliot. Chir. du Nord*, p. 188–189) relates two cases where the hand was *almost entirely cut off*, in one of them by a contusion, but which notwithstanding recovered. I have elsewhere cited the observations by Jung and Hoffman. In another case, (*Mercure de France*, 1755, t. I., p. 202; *Planque*, t. XXVII., p. 49,) it was the wrist which was restored, after having been *almost en-*

tirely separated. In a patient of Talabère, (*Ques. et Obs. Chir. Prac., Thèse de 1804*, p. 17, § 42, Strasb.) all the muscles of the middle portion of the right fore-arm, the radius, and the radial and interosseous arteries had been divided by a sabre-cut, but were nevertheless restored. An arm, wounded in the same manner by a bullet, was, if we may believe Forestus, restored in the same way by J. Carpius, (*Bonet*, t. III., p. 126, liv. de Forestus, obs. 24,) and Demarque (*Traité des Bandages*, 347) was no less fortunate in a patient who had had the arm divided by the cut of a pruning knife. The surgeon, Désire, (*Bonet*, t. VII., p. 528, obs. 81,) succeeded equally well in a similar case. The same occurred with a wounded patient, treated by Seeliger, (*Anc. Journ. Méd.*, t. LXVI., p. 356; et *Bibliot. Chir. du Nord*, 116,) though there was a considerable destruction of the soft parts; and Bordenave (*Suppl. à la Chirurg. d'Heister*, p. 50, art. 8, in octavo) has collected a number of facts of the same kind. The case of a foot, the greater portion of which was separated, and yet reunited, is related by Ledran, (*Consultat. Chir.*, p. 61, *plaie derrière le gros orteil jusqu'au petit.*) Cartier, (*Medical Facts and Observations*, t. II., London, 1792,) who relates a similar case, says the wound was complicated with luxation of the foot inwards, and he mentions having seen a man aged 60, with fracture and solution of continuity at the lower part of the leg, and which left nothing remaining but a small portion of the gastrocnemii or of the soleus, recover in thirty-six days.

To understand what reliance we ought to place upon these facts, and what is their actual value, I refer to the examination I have made of them under the article on organic restitutions.

ARTICLE II.—GANGRENE.

Though sphacelus formerly was the only lesion for which amputation was deemed necessary, it is not in reality the one which most frequently requires it, though it still constitutes one of its most positive indications. Before this can happen, it is necessary that the gangrene should have attacked the entire thickness of the part, and that it should at least be so deep-seated as to leave no hope of saving the principal tissues, (*les elements principaux.*)

In its connection with amputation, gangrene involves a question which some moderns have attempted to solve in a way quite different from that of the ancients. Pott and (before him) Sharp earnestly insisted that we should always wait until the organism had arrested the progress of the mortification, before we should think of amputating; otherwise they contend that we run the risk of seeing the gangrene invade the stump, and may thus perform a painful operation when there is no necessity for it. This manner of viewing the subject, based as it is upon an accurate observation of facts, should be adopted as a general, but not as an absolute, rule. MM. Larrey, (*Clin.-Chir.*, t. III., p. 520-553,) Yvan, (*Dissertat.* No. 425, Paris, an XIII.) Lawrence, (*Medico-Chir. Transactions*, vol. VI., p. 184,) Dupuytren, (*Leçons Orales*, etc., t. IV., p. 262-265,)

Gouraud, (*Princip. Op.*, etc., 1815,) Guthrie, Chaussier, (*Bullet. de Férussac*, t. XIV., p. 362.) Labesse de Nancy, (*Archiv. Gén. de Méd.*, t. XVII., p. 307,) Macdermott, (*Journ. des Progrès*, t. X., p. 235,) and Busch, have clearly shown that it is sometimes prudent to adopt an opposite line of conduct, and to perform the amputation before the gangrene is arrested. That this subject may be well understood, it is proper to consider separately each kind of gangrene.

§ I.—*Inflammation.*

It rarely happens, at the present time, that the surgeon allows inflammation to go on to the extent of producing gangrene in the body of the limbs. Deep, free, and numerous incisions, the liberal application of leeches, and large temporary blisters, mercurial ointment, regulated compression, and extensive dilatations, almost constantly arrest the progress of the evil, not only under the skin, but between the muscles and in the tendinous and synovial sheaths. The great articulations only would constitute the exceptions, and to these I shall return farther on. Nevertheless, if the gangrene shall not have ceased, and may have proceeded to the extent of involving the entire thickness of the part, the finger or foot for example, still, if it shall not appear to be complicated with inflammation of the large vessels above, there is good reason for amputating; otherwise we must put it off. A young man, in the year 1824, was received at the hospital of the Faculté for a wound under the ankle, (*sous-malléolaire.*) Gangrene commences; the limb is amputated; gangrenous patches make their appearance on the stump, and finally upon the thigh. The patient dies, and it is found that there has been phlebitis, together with metastatic collections of pus in the interior.

§ II.—*Hospital Gangrene.*

The species of *gray gangrene*, known under the name of hospital gangrene, does not by any means always require amputation. Ulcers around the nails are so frequently the seat of it, as to lead to the belief that there is a necrosis of the phalanx and necessity of amputating the finger. Free cauterization, however, of all the bleeding or mortified surface, by means of the nitric acid of mercury, or even by the red-hot iron, has always enabled me, in such cases, to arrest the disease and preserve the finger provided the bone was not yet necrosed. I have ascertained that the same method applies equally well upon other parts of the members; but if the surface which is to undergo the transmutation (*à modifier*) should be very extensive, the red-hot iron is to be preferred, since the application of a large quantity of the acid upon the wound might not be unattended with danger. Supposing that the diseased limb should have to be amputated, previous cauterization, nevertheless, should not be omitted, since this gangrene is of a character to attack the wound from the operation as well as the

primitive wound. Though Paulet (Pierron, *Thèse* No. 112, Paris, 1814) and others may have flattered themselves that they saved their patients by amputating, I have to remark that many of those in whom the dressing was confided to me, at the hospital of Tours, in 1816 and 1817, were re-attacked with gangrene after amputation.

§ III.—*External Violence.*

If the violence which has caused the mortification is a simple constriction or strangulation of the limb, it is perfectly useless to wait for the limitation of the gangrene. A young man, aged 24, who had been bitten by a viper, strangled his leg with a cord. The limb mortified and separated, and the sphacelus proceeded no farther, (Delacroix, *Arch. Gén. de Méd.*, 2e série, t. II., p. 587.) In a similar case, M. Petitot (*Ib.*, p. 592) amputated above the gangrene, and succeeded. The patient upon whom Park (*Excisions of Various Joints*, 1805, p. 64) amputated, after having tied the artery for popliteal aneurism, also recovered. A young man was attacked with gangrene in consequence of a contusion of the femoral (crurale) artery; he was amputated, and recovered, (*Mélang. de Chir.*, p. 212.) Josse (*Ibid.*, p. 243) also speaks of another case, in which the femoral artery, wounded by the fragments of a fracture, brought on gangrene, and in which amputation was attended with the same advantage. I have performed amputation in six cases where the mortification caused by wounds was constantly extending: twice in the arm, and four times in the thigh. M. Erard at Saint Mihiel, and M. Thomas at Revigny, have both, as M. Champion writes me, amputated the thigh under similar circumstances; and all their patients recovered. Other practitioners, however, have been less successful. A traumatic lesion was succeeded by gangrene; the leg, says M. Malle, (*Thèse de Concours*, Strasb., 1836, p. 26,) was amputated, and the patient died with an emphysema of the stump. I tied the femoral artery for a popliteal aneurism, and gangrene of the leg supervened; amputation was performed at the thigh: in the evening the stump became emphysematous, and on the following day the patient died. A similar case has just been published by M. Lauchlan, (*Gaz. Méd. de Paris*, 1838, p. 487.) Unless, therefore, we should decide upon it, as is recommended by Mehée, (*Plaies d'Armes-à-Feu*, p. 214,) on the very first appearances of mortification, I should advise, in cases of ligature of arteries or aneurisms, that we should not proceed to amputation until after the limitation of the gangrene. If the process of obliteration of the vessel is already going on during the operation, (*sous le couteau*,) the amputation will not arrest it, and the gangrene will continue. If the process is suspended, and we do not amputate, the mortification will be arrested of itself. The patient of M. Thomas (*Arch. Gén. de Méd.*, 2e série, t. XII., p. 490) was cured in consequence of this fortunate coincidence. The same may be said of that of M. Campbell, (*Gaz. Méd. de Paris*, 1833, p. 151;) also, doubtless, of those of M. Delaunay, (*Bulletin de la Faculté*, t. VI., p. 197,) Delpch,

(*Précis des Malad. Reput. Chir.*, etc.,) M. Sédillot, (Malle, *Thèse de Concours*, Strasbourg, 1836, p. 25,) and M. S. Cooper.

§ IV.—*Spontaneous Gangrene.*

Were spontaneous gangrene always dependent upon a diseased condition of the large arterial trunks, we ought by no means to amputate until its progress has been arrested. If the cause remains, it is evident that the removal of the dead portion will not prevent the remainder from becoming gangrenous. I amputated in the body of the first bone of the metatarsus, in a case of gangrene from old age, [gangrena senilis,] in the great toe. The foot was soon attacked, and the patient died. Another case had been affected with gangrena semilis for four months. I amputated at the knee; the flaps of the wound mortified, the gangrene extended to the thigh, and life terminated on the thirty-second day. But I am satisfied that the vessels are not always obstructed in spontaneous gangrene. Among the numerous examples I have in my possession, I select the two following:—A thin, small-sized woman, aged 54, died at the Hospital of La Pitié, in 1833, of a gangrena senilis which occupied the whole fore-arm. The most minute dissection in this case did not enable me to detect the least degree of lesion either in the arteries or veins. When I entered upon service at La Charité, in March, 1835, I found a patient there in whom spontaneous gangrene had successively invaded the legs, the thighs, one arm, and the nose. All the vessels that could be identified were, nevertheless, found permeable, nor did the heart appear to be diseased. It is manifest that the etiology of gangrene requires farther investigation. If we can suppose that the large arteries remained permeable in the limb in the cases operated upon by Hennen and by McCready, (*France Méd.*, t. I., p. 96,) in one of those of M. Josse, (*Mél. de Chir.*, p. 20,) and in many of those that have recovered, though the gangrena senilis with which they were attacked had not become limited when amputation was performed, this condition of things did not exist in a great number of other cases. Moublet (*Bull. de la Fac.*, 7e année, p. 227) and M. Roux, (*Voyage à Londres*, p. 53,) each cite a case where the arteries were so entirely obliterated that no ligature became necessary after the amputation. A fact of the same kind is related by Ansiaux, (*Clin. Chir.*, 2e edit., p. 278,) and I have collected elsewhere (*Journ. Hebdom. Univ.*, t. I. et II., 1830, 1831,) a number of others. Here is one of the most singular and, at the same time, one of the most curious. M. Champion writes me:—"I have amputated the leg in a case of gangrene of the leg supervening from a slight kick from a horse upon the middle and outer part of the thigh. The patient was about 60, thin, but strong and robust. The mortification presented all the characters of dry gangrene; the femoral and popliteal arteries indicated no pulsation, and I deemed it proper to wait until nature should trace out for me the demarcation of the disease before I proceeded to amputate, although

she clearly indicated that the external violence was the determining cause. None of the three arteries emitted blood during nor after the operation; I found the posterior tibial only, to which I applied a ligature around a small plug of wood, which, as I had no wax, I introduced into the extremely narrow aperture of the ossified vessel. The superficial soft parts alone, on the outer side of the leg, presented two small arteries for the ligature. Union was effected by the second intention, and the patient at present enjoys perfect health. I do not know an analogous fact, and I consider it one that possesses some interest for medical jurisprudence."

I will remark here, that the three cases that died out of the seven in which M. Porter (*Gaz. Méd. de Paris*, 1833, p. 866) states that he amputated the leg for gangrene which had not become limited, did not die from the effects of the extension of the mortification. In all of them the stump retained its vitality, (*est resté vivant*,) and without any trace of gangrene up to the termination of life.

Unless we adopt the precept of Wiseman, that we ought to amputate before the appearance of delirium, in order that the patient may have sufficient strength to sustain the operation, it is exceedingly difficult on this subject to lay down rules. For my own part, I regulate myself by these principles; if the general health is good, and the digestive functions unimpaired, if the arteries pulsate as usual, and are free from pain under pressure, and the disease progresses slowly, do not wait for the gangrene to become limited; but whether the pulsations are perceptible or not, should the arteries on the large veins seem to be the seat of an irritation, of a diffused inflammation, and violent and continued pains, and should the pulse be irregular, the tongue slimy, and the bowels constipated, be not in a hurry, but allow the disease to become arrested.

When amputation is once decided upon in cases of *non-limited* gangrene, the surgeon should always operate at a sufficient distance from the disease. Without this precaution, he would inevitably leave germs of sphacelus within the stump, and I do not think that any one would then attempt union by the first intention.

§ V.—*Congelation.*

In gangrene from congelation, [i. e., from freezing or cold. T.] we should always wait until it becomes limited, before amputating. In these cases, the disease is entirely external, and the vital action has a constant tendency to restrict it to narrow limits. If the limb is not of large size there is no serious inconvenience, even in giving time to the eschars to become slightly detached, (*de s'isoler un peu.*) We may amputate as near the disease as the flaps to be formed will admit. The operation has then every chance of success. In 1838, I saw a case of a peasant in whom all the fingers came away in this manner. The excision of the head of the bones of the metatarsus in this case was sufficient to allow the soft parts to cover the bones perfectly. [For some observa-

tions on the subject of *mortification* and amputation of the extremities from the effects of intense cold, cases of which are so abundant at this port of New-York, for example, every year in vessels making our coast during the severe tempestuous weather of winter and spring, vide a note in Vol. I. of this American Edition. T.]

§ VI.

Deep burns are in the same relation with congelation, and should be subjected to the same rules. I have amputated immediately above the elbow in a woman whose fore-arm had been burned up to the humerus, and the operation succeeded very well. In the case of a soldier, (*Delatouche, Oper. cit.*, p. 45,) amputation was performed above the carpus and tarsus in all the four extremities for gangrene from cold.

§ VII.

When a *traumatic lesion* is the cause of the accident, when it proceeds from the rupture of an artery or the division of the vein and principal nerves of the limb, or from mechanical strangulation of the part; when, in fine, mortification does not seem to be connected with any general lesion or any internal or concealed cause, we cannot perceive what great advantages are to be obtained by procrastination. In such cases the gangrene is to be considered as a cause of gangrene, and as soon as it is well established the patient cannot be otherwise than benefited by a speedy removal of the mortified parts.

If the gangrene on the other hand arises from the spontaneous obliteration of the artery or principal vein of the limb, it is perfectly clear that the amputation will not prevent it from extending. Success then depends upon chance; and under such circumstances prudence requires that we should wait. Everything, therefore, depends upon our accurately distinguishing these two classes of circumstances from each other.

§ VIII.—*Aneurisms.*

For aneurisms and wounds of large vessels we now have means of success more simple than amputation. If Fenelon (Bagieu, *Examen de plus. Qu. de Chir.*, t. I., p. 141) who died from the immediate effects of a puncture of the femoral artery, in presence of the surgeons of the court, had lived a century later, his wound would have inspired but little disquietude; and it is surprising that the preacher whom M. Pl. Portal (*Clinic. Chir.*, t. I., p. 181) speaks of should have escaped from becoming the victim to a similar accident. The ideas of Pétit and Pott on this subject are rarely applicable to the present times, and cannot be adopted except in cases where the gangrene is imminent or already established. Aneurism of

itself does not necessarily involve amputation of the limb unless the tumor be too voluminous and has caused degeneration to the surrounding parts to such depth that the ligature to the artery which is the seat of it presents not the slightest chance of success. When secondary hemorrhages, after applying the ligature, have supervened from ossification of the arteries; or when the principal nervous trunks have been divided or the vein closed at the same time with the artery; when the muscles shall have become softened (*réduits en bouillie*) or disorganized in any manner whatever, the articulations also in the neighborhood involved, and the bones friable and more or less completely destroyed; aneurism and arterial diseases may then have no other resource than amputation. It was for these reasons that it was found advisable to disarticulate the arm in a case at the Val-de-Grâce, in 1812, and that M. Auchingloss recently found himself obliged to recur to the same operation for an arterial lesion in the hollow of the axilla. I have stated above what we have to expect from amputation when gangrene has attacked the limb after the operation for aneurism. If M. S. Cooper has been successful, it is because the mortification of the limb had less tendency in his case to extend itself upward, than in that of M. Lauchlan and mine.

ARTICLE IV.—FRACTURES AND LUXATIONS.

§ I.

Compound Fractures (*les fractures compliquées*) are among the accidents which most frequently require amputation of the limbs. To justify this, however, it is necessary that the injury should be accompanied with serious lesions of the soft parts.

A. When *outside of the articulations*, and so long as the artery, vein and principal nerves are not ruptured, and the muscles preserve a portion of their continuity, it is advisable to delay. If fragments or splinters of bone are detached and buried in the midst of the tissues, they are to be removed. If either extremity of the fractured bones protrudes outside and we cannot reduce it in spite of the dilatations which sound practice authorises, it is proper to remove it by the saw, (see *Exsections*.) Even though the muscles be contused and reduced to a pulp, it does not, therefore follow, provided the tendons of some of them remain uninjured and the circulation of the fluids below the fracture is not interrupted, that the limb should necessarily be sacrificed, especially if it is an upper extremity.

Three adults having fractures of this description were cured without amputation in 1829 and 1830, at the hospital of St. Antoine while I was in service there, though two of them, suddenly seized with delirium, tore off the dressings, and marched into the hall, on the sixth or eighth day from the accident. I saw a young man at the hospital of Perfectionnement who had nearly all the muscles of the anterior and inner side of the arm and the skin on this part also stripped off and lacerated, by an injury from a spinning machine, and who,

though he had at the same time the radius and ulna fractured in two or three places, finally got well and saved his limb. In private practice we should never lose sight of these facts; that, with care and proper regimen and all the resources of a judicious treatment, it is rare that compound fractures immediately require amputation.

A woman, thrown from a carriage, had the left leg crushed; the bones and centre of the limb were reduced to a pulp, (*en bouillie*;) the livid color which extended to the thigh, and the swelling and tension, joined with the slight degree of pain that the patient complained of, induced the assistants to propose amputation. Seeing no wound of the skin, I applied a bandage and resolvents. No accident supervened, and the cure took place as in a simple fracture. Another woman came into La Charité, who had been crushed in a diligence; amputation seemed urgent, and I was sent for. The right thigh which was mashed, as well as the knee, was transformed into a sort of bag of bones, (*sac de noix*,) and as moveable as the limbs of Punchinella. An enormous effusion of blood occupied its whole extent, but the *skin was only excoriated*. The compressing bandage, and afterwards the starch dressings were applied, and everything went on as well as in a simple fracture.

B. I have seen so many of these cases that they never now give me any alarm, and I never amputate under such circumstances, not even though the fracture implicates the *large articulations*. In throwing herself from the fourth story, a young woman fell on her feet before striking her forehead upon the pavement, and crushed the tarsus and the inferior extremities of the bones of both legs. I found the tibio-tarsal regions completely reduced to a pulp, while the fracture of the cranium precluded at first all idea of amputation. This woman was submitted to the treatment with the starched bandage, (compression inamovible,) and was perfectly cured.

But if the soft parts are extensively crushed and lacerated down to the bones, the question assumes another aspect. Wherever the injury involves an extensive articulation, the foot, knee, hand and elbow for example, amputation is then to be preferred. In the lower limbs it should be performed, even though the joints are not laid open. In the arm, on the contrary, it is rare that fractures complicated with wounds and lacerations of the soft parts, do not admit of preserving the limb, provided the articulations are uninjured. A man was admitted into the hospital with the humerus comminuted. The muscles were ruptured. The skin open in two places appeared filled with pulp. The arm already emphysematous, was tumefied as high up as the shoulder. An abundant hemorrhage took place, but still the artery was felt at the wrist. I applied the immovable dressing, and the patient recovered without any accident. A woman similarly situated, and who had refused to undergo amputation, had recovered in the same way a few months before.

C. We must not, however, in these cases go too far. In the

lower extremities especially these grave injuries but too often require amputation. Of three patients in this state received at the hospital of St. Antoine, and in whom I was anxious to save the leg, two died in the course of a few days, and the third owed his preservation to amputation performed on the fourteenth day on account of gangrene. It is true that a fourth, though immediately amputated, nevertheless died on the seventh day; but in him there was so little vital action after the operation, that he was scarcely conscious of what was done to him. The emphysema, which is sometimes added to the other complications of fracture, even from the first day, and before the appearance of any symptom of gangrene or inflammation, is one of those accidents which under such circumstances most emphatically indicate amputation. Though no person has hitherto pointed it out, I have noticed it in six cases, and three out of the five in whom the leg was the seat of the disease, died. Against the numerous facts stated by Bardy (*Thèse* No. 176, Paris, 1803) and De la Touche, (*Sur l'Amputation*, 1814, Strasbourg,) to show that in cases of comminuted fractures with lacerations of the soft parts, amputation is scarcely ever necessary, M. Bintot (*Thèse* No. 306, Paris, 1827) has adduced others not less conclusive, going to prove directly the reverse.

§ II.—*Luxations* (or dislocations.)

Dislocations, complicated with laceration of the soft parts, are sometimes followed by symptoms so formidable and appalling, that they were at an early period placed amongst the cases that imperiously require amputation. The remark of an army surgeon, which made so vivid an impression on the mind of J. L. Petit, and which was to the effect, that every dislocation of the foot, with laceration of the integuments and protrusion of the bones externally, was fatal unless amputation was performed immediately, has unfortunately since that time been but too often confirmed. The agonising sufferings which come on when the inflammation sets in, the gangrene which is frequently the consequence of it, and which nothing can check, and the most excruciating torments terminating in death, which last seems alone capable of arresting the march of the disease, have been deemed to be reasons quite sufficient to justify the surgical law upon this subject.

Experience has, nevertheless, demonstrated that this rule has numerous exceptions; which J. L. Petit himself has taken the precaution to point out. M. Laugier, (*Thèse* No. 51, Paris, 1828,) M. Arnal, (*Journal Hebdomad. Univ.*, t. I., II., III.,) &c., have also furnished additional evidence of this fact. If the laceration is not excessive; if the bones are merely luxated without being broken; if the nerves and principal vessels are not ruptured; if, in fine, gangrene should not appear inevitable, we should replace the parts, excise the bones, or have recourse to dilatations, and not at first proceed to amputation, except under an opposite condition of things; that is, where the teguments, tendons, ligaments and capsules of the

joints are extensively lacerated, the bones and soft parts at the same time both torn and crushed, (*déchirés et broyés*,) or violently contused, (*violemment contus*,) and the articulation too much implicated or of too little importance to be saved without the risk of danger.

A. As to the election which is to be made in these cases between exsection (*résection*) and simple reduction, this is shown by the state of the parts. In the upper extremities, says M. Champion, I prefer simple reduction to exsection, because this latter is so frequently followed by ancliyosis. Exsection, whatever may be the locality of the luxation, becomes absolutely necessary wherever the extremities of the bones are denuded of their periosteum, and dry (*dissechées*) and shattered, (*brisées*.) In twenty-six of these cases collected by M. Patry, (*Thèse* No. 289, Paris, 1837, p. 26,) from La Motte, Coligny, Dupuytren, A. Cooper, and Thierry, three only died. In the foot, even reduction may be preferable; though the formidable accidents which follow wounds with luxation of the tibio-tarsal articulation, would induce me to adopt, with M. Champion, exsection to simple reduction, if the latter was attended with the least difficulty, seeing that the removal of the extremities of the bones is so powerful a means of preventing the accidents of inflammation. Of seven cases thus treated, and which are related by Deschamps, Hey, Moreau, Cooper, de Bungay, MM. A. Cooper, Josse and Bintot, one only proved fatal. At the knee, however, amputation should be preferred to all other means, and exsection should not be attempted except in persons who are not obliged to get their living by some severe and laborious occupation. I will return to this subject farther on, in treating of amputations in particular, and of exsections. Among these cases, [of reduction. T.] though there may be some who will die that might have been saved by amputation, there will be a much greater number who will survive and preserve their limbs.

B. A remark to be attended to here is this, that whether we have to treat a fracture or a compound dislocation, should amputation become necessary, we must, as in cases of non-limited gangrene, perform it very high up. I cannot understand how Lassus, (Pott, *Traité des Fractures*, 2e edit., p. 181) should have said that it is better to remove the contused parts on a line with the fracture, than to go to the trouble of sawing the bones above it. It is so seldom, under such circumstances, that the fractured bone is free from all cracks, (*féture*,) and that the cellular tissue, aponeurosis, and muscles are not disorganized at some inches above the apparent lesion, that there would be real danger if we did not amputate higher up. A slater had his foot crushed by the wheel of a carriage. I amputated the leg after the expiration of a few hours, and I performed the operation at three inches above the malleoli, after having asked myself the question, from the contusion appearing so circumscribed, if it would not have sufficed to have taken off the foot at the tarsus. The mortification of a part of the tegumentary ruff, (*la manchette tégumentaire*,) and the livid color from

extravasation, (la teinte ecchymotique,) which soon attacked the sub-cutaneous tissues of the stump, showed us that lower down, the operation would have failed from the effects of the gangrene. In another patient the leg was shattered at its lower third. I amputated below the knee at six inches above the apparent lesion. Death ensued, and enabled us to ascertain that the contusion extended under the skin up to the thigh, especially on the outside. A third patient was more fortunate; though the leg only had been injured by the wheel of a diligence, I amputated the thigh; nevertheless, strips and pieces (pelotons) of mortified cellular tissue ultimately sloughed off from the stump. The same rule applies to those cases where the contusing body has separated the limb from the rest of the economy, or so to speak, has itself performed the amputation. If, under such circumstances, we do not also remove with the wounded parts themselves, all the neighboring tissues (*toute l'atmosphère contusive*) which have been injured by the blow, we may be prepared for gangrene of the integuments, diffused phlegmon, and mortification of the cellular tissue, together with denudation of the bone.

§ III.—*Wounds from Fire-arms.*

No wounds more frequently require amputation than those from fire-arms. It is not that the projectiles lanced by powder have in themselves anything of a poisonous nature, as some surgeons have supposed, since the time of A. Ferri, or as the vulgar are also too prone to believe; but because they lacerate, tear, contuse, or cut into (escarrifiant) the tissues they traverse or strike.

A. A ball, or biscaien, a grenade, or the bursting of a bomb or howitzer, carrying away a part of the thickness of the limb, including the vessels with it, requires amputation; while a similar wound effected by a cutting instrument would not, perhaps, make it necessary to have recourse to such mutilation. If the same missiles had struck the body of the arm or thigh so as to reduce the muscles to a pulp, without breaking either the skin or bones, still amputation would be necessary, unless the attrition should be exceedingly circumscribed, and the vascular and nervous trunks uninjured.

B. Wounds complicated with *fractures* in an especial manner, indicate this extreme alternative. In the joints, if the destruction is considerable, there is no time for delay. A difference of opinion among practitioners exists only where the joint is not greatly exposed, and where the osseous extremities have merely been traversed or fractured (*brisées*) by a ball. In these cases we must be governed by the circumstances, thus:—where we have it in our power to pay every necessary attention to the patient, and the ball has merely passed through the wrist, elbow, instep, shoulder, &c., fracturing the articular extremities without lacerating the tendons and other soft parts; ought we not then to endeavor to save the limb? On the contrary, on the field of battle, in hospitals crowded with

the sick, and when some fatal epidemic is prevailing, and we can neither obtain quiet nor repose, nor those assiduous cares which are so indispensable, and where the fracture, too, is complicated with splinters of bone, and the ligaments, synovial tissues and tendons are bruised and torn, amputation is more advantageous to the patient than temporization.

M. Labastide, (*Thèse sur les Blessures par Armes-à-Feu*,) desirous of sustaining the principles of Bilguer, has, it is true, collected quite a great number of examples to prove that such wounds at the wrist, elbow, foot and knee, have not always rendered amputation necessary for the recovery of the patient. Similar cases noticed at the Maison de St. Cloud, among the wounded of July, as treated by Dupuytren, have been published by M. Arnal, (*Journ. Hebdomadaire*, 1830-1831. t. I., p. 385; t. II., p. 497; t. III., p. 5, 33.) Faure, Percy, Lombard, and Leveillé, (*Soc. Méd. d'Emulat*, t. V., p. 192-234,) have also reported analogous cases; but how many reverses might we not oppose to these unhoped-for successes!

C. The gardener of the director of one of the theatres of the capital, had a part of the metacarpus and fingers carried away by a musket which burst in his right hand. He was brought to the St. Antoine, and begged me to save the thumb and fore-finger, which were left; I yielded to his solicitations. Serious symptoms supervened and death was not prevented by the amputation of the arm fifteen days after. One of the wounded of July had his heel perforated by a ball, and the tibio-tarsal articulation laid open on its posterior and outer part. As there was not much destruction of the parts, we were desirous of preserving the limb. On the 18th day the patient died. Another patient also admitted into La Pitié, had a large wound with fracture of the elbow, and an opening into the joint. Amputation was not performed, and the patient perished like the others, from the effects of purulent infection. A young man in my service had the osseous extremities of the articulation of the knee obliquely traversed by a ball, at the taking of the Hôtel-de-Ville; there were no splinters (*esquilles*) nor any laceration of the soft parts. After a month's care we were compelled, nevertheless, to have recourse to amputation of the thigh, which did not prevent death from taking place thirteen days after. It is, to say the least, probable, that had amputation in some of these cases been performed at the very onset, life might have been saved.

D. It is not in the neighborhood of the complex articulations only, that wounds from fire-arms, accompanied with fracture and with lesion of the synovial cavities are so dangerous; they are scarcely less formidable in the *middle portions of the long bones*, especially in the lower extremities. Thus a simple ball, which breaks at the same time the tibia and fibula, and detaches also a certain number of splinters, is almost always a case for amputation. Where there is one patient, under such circumstances, who refusing to be operated upon, gets well without amputation, there are ten that die if the soft parts are at all injured or violently contused.

E. *The Thigh*.—In the thigh the indication is much more positive. Ravaton says, if we do not amputate, this fracture almost always proves fatal. Schmucker maintains, that in cases of this nature, only one patient is saved out of seven. Lombard holds the same language. M. Ribes, (*Gaz. Méd. de Paris*, 1831, p. 101,) who has seen none recover, gives the history of ten cases, in whom the utmost care could not prevent a fatal issue, and mentions, also, that at the Hôtel des Invalides, in an aggregate of 4,000 cases, there was not a single patient that had been cured of this kind of wound. M. Yvan pointed out two to him in 1815, in whom, however, fistulous openings formed, and who ultimately succumbed from the consequences of their fracture. I notice that M. Gaultier de Claubry, (*Journ. Hebd. Univ.*, t. V., p. 479; *Journ. Gén. de Méd.*, t. LVII.,) formerly a surgeon of the Imperial Guard, is on this point of the same opinion as M. Ribes, and that in the army of Spain almost all the soldiers that had fracture of the thigh died unless amputation had been performed immediately. Out of eight treated by M. S. Cooper after the battle of Oudenbosh, one only survived, and he never was enabled to make much use of his limb. Percy, Thompson, MM. Larrey, Guthrie, and J. Hennen, express themselves nearly in the same terms, and the events of July, 1830, enabled most of the surgeons attached to the hospitals of Paris to recognize the truth of this melancholy prognosis.

Though one of the cases of wounds of this kind was saved by M. Lisfranc, at La Pitié, and another by Dupuytren, I had not the same good fortune; there was but one only received in my wards, and the fracture appeared to be quite simple; nevertheless we could not prevent death, which put an end to his sufferings on the 38th day. Sommé, (*Journ. Hebd. Univ.*, t. I., p. 221,) during the events at Antwerp in Oct. 1830, cured 2 cases out of 8, without amputation. Lassis, (*Gaz. Méd. de Paris*, 1830, p. 322,) and other surgeons of Paris and Brussels, have published other cases not less fortunate; but we must not forget, that among us, as in Belgium, even where we have had it in our power to bestow the same attention that we habitually do to patients in private practice, the instances of success have, nevertheless, been exceedingly rare, and the limb saved has generally been so deformed, that its loss would scarcely have proved a greater source of affliction to the patient. It is to be remarked, also, that a fracture of the thigh is so much the more dangerous in proportion to its proximity to the middle portion of the bone, both because the splinters and fragments (*les éclats*) shivered off are more common in that part, and also on account of the number, arrangement, and force of the muscles.

It is painful, without doubt, to mutilate a patient, in whom the limb might have been preserved; but the argument drawn from certain unlooked-for cases of recovery, in patients who had refused the operation, has it, in fact, all the value usually accorded to it? Admitting that in ten persons wounded in this manner, four are cured; it is certainly a good deal. But in submitting all of them to amputation at the beginning, is it not to be presumed that two-

thirds of them at least would have been saved? I leave it to conscientious men to decide whether the saving of the life of two or three persons in the vigor of age, is not preferable to a deformed limb, which can only be saved, perhaps, in four cases [out of ten,] and at the risk of a thousand dangers.

ARTICLE VII.—VARIOUS AFFECTIONS.

§ I.

Necrosis and *caries* also, either in the middle part or in the articular extremities of the bones, find their last resource in amputation. To justify this, however, it is necessary that the evil should be extensive, ancient, and accompanied with sufferings and suppuration which are exhausting to the patient; that it should occupy a joint or large surfaces, and be surrounded with fistulous ulcerations or deep-seated devastations in the soft parts; that the bone should be diseased throughout its whole texture, (*épaisseur*), if it is in the continuity of the limbs; and that we cannot count upon any reproductive action from the periosteum: but it is important, in such cases, not to forget that the organism possesses great power, and that art, at the present day, has at her command the means of removing the bones in part, without removing the limb, provided the soft parts are in a condition to be preserved, (See *Trephining and Exsection*.)

§ II.—*Cancerous Affections.*


Spina ventosa, *osteo-sarcoma*, and *colloid*, (*colloïde*), *hydatid* and *erectile degenerations*, affecting the bones, also frequently require amputation. These affections are of such a malignant character, that we deem ourselves particularly fortunate in being enabled to destroy them effectually, even at the sacrifice of the part in which they are seated. Unless they should occupy an exceedingly superficial, long, or small-sized bone, easy of excision, we should not hesitate a moment about amputating. If the soft parts are also implicated in the degeneration, amputation becomes a case of necessity. It is the same with *fungus hæmatodes*, as soon as it is found impossible to extirpate it in its totality, without altering the continuity of the bone or bones of some important regions of the limbs. M. Hervez de Chegoïn (*Journ. Hebd. Univers.*, t. II., p. 117) has clearly established, that extirpation or amputation, where practicable, is the only effectual remedy—for example: for sanguineous fungoid tumors, made up of heterogeneous tissues and encephaloid matters, and when they have reached to a certain depth in the organ—except that we must take care not to confound them with simple erectile tumors, which at the present day are cured by much milder means. As to cancers, properly so called, it is not required that they should have penetrated to the bones before we proceed to amputation. If they are large and immovable, and go deeper

than the integuments, and implicate the aponeuroses, muscles, vessels and nerves, we should compromise the life of the patient by attempting to preserve the limb. The greatest misfortune in all these cases is, that amputation itself is no certain security, always, against a return of the disease. A young man, in other respects in exceedingly good health, came to La Charité for an enormous fungus hæmatodes upon the calf of the leg. Through fear, I concluded to amputate at the femur; but the wound of the stump had not yet healed, when the disease had already invaded the remaining part of the thigh.

§ III.

Nor do *exostoses* and *fibrous* tumors, whether of the species elephantiasis or otherwise, unless they should be exceedingly voluminous, or should have compromised the general health and destroyed the natural functions of the part, or cannot be taken away separately and completely distinct from the bone, and from the neighboring organs most essential to the maintenance of life in the rest of the limb, absolutely require amputation.

§ IV.—*White Swellings*, (tumeurs blanches.)

 Numerous observations have shown that white swellings yield more frequently than had been generally imagined, to the resources of a judicious therapeutic, and that we should not, so long as the caries or suppuration of the articular surfaces is not clearly established, have recourse to the removal of the limb, until we have exhausted upon the disease all the means that our judgment enables us to suggest. The phrase *white swelling* is, moreover, one of too vague an import, at the present day, to have any value as an indication of amputation, (Jeanselme, *Arch. Gén. de Méd.*, 1837.) It is upon the character of the disease and of the tissues affected, and not from the title of white swelling, that we are to make up our judgment upon the propriety of amputation in diseases of the joints, (arthropathies.) If the capsule has been for a long time filled with pus; if there are fistulas existing about the joints, and the friction made on the surfaces leave no doubt as to the extent of the necrosis or caries; if, also, the ligaments and surrounding fibrous layers are destroyed, and an ichorous fluid escapes in large quantities, and a fungoid or fatty degeneration has involved the synovial membrane and most of the soft tissues; if the limb be atrophied both above and below, and is luxated, or has a tendency to become so; if, in a word, it is manifest that the bones and the cartilages have been for a long time the seat of a deep-seated, destructive alteration in the parts; then is amputation indicated: though the cure, even where all this mischief exists, does sometimes ultimately take place in the articulations, especially in those of the fingers.

§ V.—*Suppuration*.

Unless suppuration should derive its source from some disease

in the bones, it rarely happens, whether it be of long standing or recent, superficial or profound, or is ever so abundant that it renders amputation absolutely necessary. Regimen, judicious medication, incisions and suitable dressings, ought to be sufficient to dry up its source. In the contrary case, we should look for the cause in the general condition of the patient, or trace it to some internal lesion; in which case amputation would but hasten the progress of the disease. We admit the dangers of those suppurations which sometimes invade the greater portion of a limb, and are ordinarily the result of inflammation of the synovial capsules, the tendinous sheaths, or inter-muscular tissue; and every person has been enabled, on this head, to make observations similar to those of Lecat, (*Propriétés des Nerfs*, p. 202.) But as these dangers are not always present, as death is not always their inevitable result, and as it is practicable to make successful resistance against or entirely to prevent them in a good number of cases, suppuration of the soft parts, without degeneration of the bones, ought not to be ranged among the indications for amputating the limbs. I have, moreover, had an opportunity of witnessing three patients on whom it was performed, and who sank as rapidly, or more so even, than they would have done had they not been operated upon. In the two first a suppuration, which numerous incisions had not been able to arrest, occupied almost the whole of the fore-arm; in the other, the evil, which did not approach so near the wrist, had reached to above the elbow. They were all amputated at the arm, and they died before the fifteenth day, with purulent deposits in the viscera. In fine, if the suppuration is purely local, and the destruction of the tissues slight, amputation is not indispensable; and should it be kept up by constitutional disease, (*une disposition interne*,) it will not succeed.

§ VI.

Corroding ulcers, lupus, and phagedenic sores, (*les esthiomènes*) of the legs, which formerly constituted one of the principal indications for amputation, do not in reality require it, or do not exact it at least, but in a very small number of cases, as when the skin is destroyed and the muscles laid bare, (*disséqués*,) to a great extent around most of the limb; nevertheless, it is proper that the patient should desire the operation, and that he should be convinced that there is no hope of curing him by any other mode.

§ VII.

In *Tetanus*, for which M. Larrey, (*Clin. Chir.*, t. I., p. 27 à 131,) M. Del Signore (*Arch. Gén. de Méd.*, t. II., p. 298) and some others have had the courage to employ it, is it possible that any advantages could be derived from it? Would it not rather be aggravated than cured by the removed by the limb? I am aware that a man from the country was saved in this manner by Dubois, that Levesque-Lasource (*Bull. de la Fac. de Méd.*, 7e année, p. 100) has published a

similar fact, and that we find here and there in periodical publications other examples of success obtained in the same manner. Nevertheless two of the patients operated upon by M. Larrey died notwithstanding the amputation, and the state of the third leaves the matter in doubt as to the real nature of his disease. If in itself the wound which has caused the tetanus should be of so serious a nature as to justify an extreme measure, the access of this frightful disease would without doubt weigh in the balance as a determining motive. But in other cases I should be so much the less disposed to follow the example of our celebrated military surgeon, inasmuch as amputation is, as is known, in itself a potent cause of the very disease for which it is here proposed to employ it as a remedy.

[*Amputation for Tetanus.*—As illustrative of this subject the following facts may be useful :—

Sir Geo. Ballingall (*Outlines of Military Surgery*, Edinburgh, 1844) gives an important fact which he derived from Deputy Inspector Marshall, to show that the statements touching the *production of tetanus* by *punctured* wounds have been greatly exaggerated. Out of one hundred cases of *arrow* wounds at Ceylon, (East Indies,) Mr. Marshall did not, even in the heat of that climate, which as we see in all tropical countries, constantly predisposes in all diseases to complications of tetanus, trismus, spasms, convulsions, &c., meet with a single case of tetanus !

Dr. Casper of Berlin (vid. Casper's *Wochenschrift*—also *Journ. des Connaissances*, &c., Paris, Août, 1844, p. 74) relates the case of a man aged 35, who having had a corn removed from the little toe of the left foot by too deep an incision, continued notwithstanding the pain which ensued to do his duty as a domestic where he was employed, until he had to take to his bed. M. Casper found the patient complaining of no other symptom than the pain in the part from whence the corn had been extracted, and in place of it a vesicle filled with blood, the foot also being swollen throughout its whole extent. In a day or two came on difficulty of swallowing, stammering, and difficulty of articulation, though preserving all his mental consciousness perfectly. Tetanus followed with death the same evening. Pus was found effused under the integuments, and the mucous bursa over the articulation was filled with blood ; but no lesion was discovered on the branches of the fibular nerve which are distributed to the toes.

Dr. Aberle (*Jour. des Conn. Méd. Chir.*, Paris, Nov., 1844, p. 208) relates an instructive case in which it finally became necessary to amputate the medius finger for a wound from a splinter (*écharde*) under the nail, which the patient, a female aged 22, had supposed she had extracted. The paroxysms of tetanus which had continued daily for weeks, and which were kept under and ultimately reduced to one a week by repeated small enemata of equal parts of spirits of turpentine, olive oil, and mucilage of gum arabic, finally returned with all their force and induced the patient to consent to the operation. Immediate relief was obtained, but to the dismay of all it was found that though the wound on the point of the finger had

cicatrized a portion of the splinter (*écharde*) was found buried in the nerve ! The patient recovered completely.

Mr. Miller, Professor of Surgery in the University of Edinburgh, in a case of traumatic tetanus (*Cormack's Lond. and Edinb. Monthly Jour. of Med. Sc.*, Jan., 1845, p. 22, &c.) in a girl aged 7, from injury to the right middle finger caused by a cart wheel passing over it, and in which case unequivocal tetanic symptoms developed themselves on the 20th day after the accident, in trismus and pain of the jaws, opisthotonos, rigidity of the upper extremities and abnormal muscles, immediately on the day of their appearance performed amputation at the metatarso-digital articulation. The case was then treated with large doses of the *cannabis Indica*, (Indian hemp,) sometimes to 30 drops of the tincture (equivalent to three grains of the resinous extract) every half hour, together with bags of cold ice to the upper part of the spine. He places much reliance on Indian hemp, as from his experience in this case its extraordinary anti-spasmodic and *narcotic* effects, though it may be comparatively useless as an *anodyne* in ordinary cases of disease, are wholly exempted from the objections to opium, morphine, aconite, &c. For instead of constipating the bowels it creates an inordinate appetite, (especially in convalescence,) which enabled the Professor during the treatment, which however was prolonged to two months before the tetanus was subdued, to administer constantly a supply of wholesome nourishment (strong beef tea) to replenish the exhausted excitability necessarily caused by such severe and morbid exercise of the muscular power of the whole system of voluntary muscles. He recommends also careful attention to evacuation of the bowels, but above all early amputation of the injured part upon its cardiac aspect. To show the power of the *cannabis Indica* in controlling muscular spasm, and the *extent also to which morbid muscular power is developed* in tetanus, it may be remarked that large as the doses were on this young and slender girl, none of its unpleasant effects were produced. Dr. O'Shaughnessy, from what he saw of the virtues of the Indian hemp in India in tetanus, was induced to commend it strongly to the notice of British practitioners, (See *British and Foreign Medical Review*, July, 1840, p. 225,) and it is worthy of further trials after those of Mr. Miller given above, as a valuable adjunct to early amputation—instead of the disturbing herculean doses of opium, wine, alcohol, &c., formerly in vogue in tetanic affections, especially in traumatic tetanus. T.]

§ XII.

The bite of rabid animals is also, in the estimation of some, a case for amputation. M. Calloway (*Clinique des Hôpitaux*, t. I., p. 16) had no qualms about taking off in this manner the arm of a person who had been bitten in the hand, and who, by the way, (*par parenthèse*,) died nevertheless of hydrophobia in eight hours after. At farthest we should never think of it, except for a finger for example, unless the wounds are so extensive, complicated and

deep that we cannot cauterise or in any other manner excise their whole track; the amputation also should in such cases be performed immediately, as in a lady whose case was transmitted to me by M. Champion; for after the absorption of the virus has once taken place, how can it be of any utility?

ARTICLE VI.—AMPUTATIONS OUT OF COMPLAISANCE,
(amputations de complaisance.)

Anchylosis, complete or incomplete, deformities of different sorts, ancient ulcers that are incurable, or where the cure is not permanent, or any annoying condition whatever of certain parts of the limbs, often induce patients to demand relief from them at whatever sacrifice, though their life and general health are not in any manner endangered.

As a general rule, a discreet physician ought, in such cases, to resist the entreaties of persons who consult him. There is evidence, in fact, to show that the operations which are denominated those of complaisance terminate sufficiently often in an unfortunate way. In 1821, there was received into the Hospital of St. Louis, a man of robust make, in the vigor of age, and in other respects enjoying the most flourishing health, but with the firm resolution of having his thigh cut off for an anchylosis of the knee, which obliged him to use a crutch. After having remonstrated with him in every possible way, and traced out to him as black a prospect as could be portrayed of the dangers to which he would be exposed, M. Richerand finally acceded to his entreaties; the amputation was one of the most simple; no local accident supervened; but an ataxic fever, which soon supervened, ended, nevertheless, in death on the fifth day. Pelletan cites a similar fact. I saw some quite as striking at the Hospital of Tours, from 1815 to 1820, and M. Gouraud, then surgeon-in-chief of that establishment, finally came to the resolution, as Dupuytren did afterwards, of giving a flat denial to these pressing requests of patients. In 1825, a countryman who had been an old soldier, annoyed at having a large leg, and carrying a dry ulcer (*ulcère sec*) behind the malleolus, presented himself in the wards of the School of Medicine with the idea of having his limb amputated. It was in vain that M. Roux endeavored to alarm him, and to make him feel the rashness of his project; nothing could shake him. The operation presented nothing peculiar; the first days went off as well as could possibly be desired; but constitutional symptoms supervened, and the man died at the end of the week.

What is worse, amputations of the least importance in themselves, those of a finger or toe for example, have not unfrequently been followed by similar results.

In 1829, there was received in the Hospital of St. Antoine, a shoemaker whose left fore-finger had been for a long time held firmly and immoveably fixed upon the palm of the hand. I operated upon him, and this patient, who did very well at first, and

finally recovered, was, during fifteen days, so severely affected, that on two different occasions I thought there was no hope for him. A young peasant girl came into La Charité to have an amputation of her left fore-finger, which was retracted backwards, and adherent to the dorsum of the metacarpal bone; she died of phlebitis and of purulent peritonitis on the eighth day after the operation!

Nothing is more common than examples of this kind, and there is no practitioner who has not had occasion to see them. From thence has arisen a question among modern observers which the ancients seem never to have thought of: ought a practitioner to limit himself to simple explanations? Is it not his duty positively to refuse to perform operations which are not indispensable? At Paris, many surgeons have answered negatively, and violently oppose those who amputate under such circumstances. For myself, I find the question badly stated, and here is another one which may be brought into consideration. Does humanity allow that we should condemn a man to carry forever an infirmity which renders life a burden, merely because that in the attempt to get relieved of it, he may be exposed to more or less serious dangers? If that were the case, we should never interfere with lupus, nor tumors of any kind which are developed upon different points of the body; for they are rarely dangerous in themselves, and the operations we are obliged to employ to remove them may give rise to formidable accidents, or even cause death.

Far be it from me to justify those who are in haste to perform amputation of the limbs for lesions which do not absolutely require it, and for simple annoyances, and merely because the patients wish to be relieved of them; but I would ask if it be not conformable to a sound surgery to have recourse to it for deformities which we cannot otherwise get rid of, when those deformities are of a character to destroy the natural uses of an important part of the body, to give rise to pains, and to make them a source of trouble and continual suffering, and when the patient also has decided upon it, and maturely reflected upon the consequences which may result from his determination?

Dominique de Vic, (Governor of Amiens, (*Essais Historiques sur Paris*, par Sainte-Foix, t. V., p. 108,) in 1586, having had the fleshy portion of his leg carried away, and being thus incapacitated from mounting his horse without experiencing the most acute pains, went into retirement for three years. Hearing that Henry IV. required the services of all his subjects, he caused his leg to be amputated, sold a part of his property, went to find his prince, and rendered him signal services at the battle of Ivry, and on many other occasions. Can he be blamed?

A captain of marine having lost his foot, had the leg cut off near the knee, because, says Paré, (*Œuv. complèt.*, liv. XII, chap. 29,) he found it too long. Villars, as cited by Briot, (*Hist. de la Chir. Milit.*, p. 185,) did the same. Ought Sabatier to cast reproaches upon these practitioners, he who so long felt the embarrassment of

too long a stump to the leg? I would not like Odier (*Man. de Méd. Prat.*, p. 362,) go to the extent of amputating the fore-arm for a simple neuroma, (névrome,) nor for an ankylosis of the wrist, which caused no pain, nor for a false articulation, unless under circumstances altogether peculiar; but I should decide in favor of it in the following cases.

§ II.—*Ankylosed Fingers.*

Whether deformed, flexed or extended, straight or deviated, an ankylosed finger is not only a useless organ, but a perpetual source of trouble, pain and accidents. If there be no other remedy, amputation is allowable. I have performed it seventeen times, and of these, fifteen of the cases were cured.

§ II.—*Supernumerary Fingers.*

Without being as annoying as those that are ankylosed, supernumerary fingers are enough so to justify their removal. I have amputated them on the thumb and little finger, and the little toe, and have had no reason to regret doing so. I saw—it is now twenty-four years since—a child of four days old, who had seven fingers on each hand; the thumb and little finger were double; I amputated them successively, and united by first intention. In 1837, I amputated, writes M. Champion, the two great toes that were double upon the child of the preceding case, and I separated apart the middle and ring fingers, which had been united at their two sides. In conclusion, I do not know what remark to make of the case of a double thumb, in a child of 3 years, amputated at the joint by Ch. White, and which was reproduced to the extent of causing W. Bromfield to amputate it a second time, which, however, did not prevent its reproduction again!

§ III.—*Toes raised up or angulated, (orteils relevés ou coudés.)*

Whatever may be the deviation of any one of the three middle toes, it is rare if they are at all prominent that the person does not experience pains, and an extreme degree of annoyance in walking or wearing shoes. In such cases, should the patients demand it, I amputate. I have performed it on five persons, two of whom were students of medicine, and although in one of these it was followed by some accidents, they all got well.

§ IV.—*Ankylosis of the Large Joints.*

So long as there is a chance of curing ankylosis, of assuaging the pains, or of putting the patient in a condition to walk, though it should be with crutches, I decline an amputation of the limbs properly so called; otherwise I am governed by circumstances. A man from Provence who, in consequence of successive inflamma-

tion of the joints, (arthropathie,) had the hips, knees and feet ankylosed (soudés), with the legs and thighs bent into a serpentine direction, so as to be unable to stand erect, or to seat himself, or lie upon his side, obliging him thus to pass his life upon his back, sought in vain at Lyon, Nîmes, Avignon and Toulouse for a surgeon who would amputate his two thighs, and then came to Paris with the hope of attaining his object. I, like the others, at first refused. "Though a cripple, I might then, said he to me, be enabled to occupy myself and live. But as I now am I do not exist. Amputation you say might kill me; that is not so certain. Besides I suffer, and I do not wish to live if I am to remain as you see me. Therefore I leave here either my legs or my body!" The two amputations were attended with complete success, and he returned as happy as a god!

§ V.—*Ulcers with Loss of Substance.*

In consequence of extensive burns, gangrene, phlegmonous erysipelas, or old ulcers, it may happen that the integuments throughout the whole circumference of a limb are destroyed, together with the aponeurosis and some of the muscles, to such extent as to render cicatrization forever impossible. If the patient desires it, amputation is applicable here also; but in all such cases I wait for the patient himself if he is an adult and has his reason, or in the contrary case for his parents, to demand the operation. I do not decide upon it but at their entreaties, and after having pointed out to them all its dangers and chances.

CHAPTER II.

PRELIMINARY CAUTIONS.—(Soins Préalables.)

ARTICLE I.—COUNTER-INDICATIONS.

Before amputation is performed it is not only necessary that the disease which requires it should be one that cannot be cured in any other manner, but also that we be enabled to remove the whole of the disease, and with a rational prospect of saving the life of the patient, (Malle, *Contre-Ind. aux Opér.*, Strasb., 1836.)

§ I.

When the disease is a *cancerous* affection, it is important to make ourselves assured that there exists no germ of it in the viscera. If a diseased condition of the lymphatic glands is observable at the upper part of the limbs, and that the color of the skin, the state of

the respiration and digestion, or any other symptom whatever indicates that the disease is not confined to the surface, amputation is useless and would only serve to hasten the development of lesions analogous to those we desire to relieve.

§ II.

Pulmonary phthisis, necrosis (Mehée, *Plaies d'Armes-à-Feu, etc.*) *caries of the vertebral column*, (Lassus, *Fract. de Pott*, p. 181, 1788,) abscesses from congestion, any organic lesion of the heart, liver, stomach, or genito-urinary passages, &c., extreme prostration, (*épuisement profond*,) intestinal ulcerations in considerable numbers and of long standing, coincident or not with a colliquative diarrhœa, are, unless in a case of urgency, (see Vol. I. of this work,) so many positive counter-indications, (Delatouche, *Dissert. sur l'Amputation*, Strasbourg, 1814.) In fine, in all cases where in the removal of a limb we leave in the organization a disease of such gravity that death will almost inevitably follow, we ought to abstain from the operation. When it is for a scrofulous, syphilitic or rheumatic affection, we have to apprehend that it will soon be reproduced in other parts of the limbs, and may oblige us, if we propose to follow it up, to perform successively a number of amputations. We ought, therefore, in such cases to have at least a strong reasonable prospect of being enabled to limit the progress of the general disease, in fact to retard its advancement and ultimately to extirpate it effectually. Prudence, for example, does not permit us to amputate a limb affected with rheumatic or *syphilitic* caries or necrosis, if other parts and some of the articulations are already the seat of swellings, pains, and other primary symptoms of a similar affection.

§ III.

In regard to *scrofula*, however, it had been for a long time noticed that the removal of an important part from the body was often followed by a favorable change in the general health of the patient; that after the cure debility has been succeeded by manifestations of strength, and of the most flourishing health. This is a change which we may readily comprehend: an abundant suppuration, protracted pains, and a disorganized condition of the articulations, constitute a morbid cause calculated continually to impair the functions, and cannot fail of keeping up in the economy a sufficient degree of disturbance to impede the development of the natural resources of the system. In removing, therefore, this real cause of suffering and danger, it is very natural that the health should afterwards be re-established; that nature ceasing to be disturbed and embarrassed in her efforts, should then be enabled to suppress less serious lesions, and to preponderate over a morbid process whose principal source has been destroyed.

§ IV.

One of the first questions to decide is to know if there are really any internal diseases existing, and to ascertain their nature, for if these be incurable amputation is inadmissible. The next question is to determine the source of the mischief, for if this be external then amputation is formally indicated, but if elsewhere, the contrary. As often as a local affection is the result of general disease, we must entirely subdue this latter before thinking of removing the former, which, according to correct practice, does not allow of amputation until it becomes reduced to what exists of it externally. A minute examination of the patient before coming to a final decision, is so much the more important, inasmuch as most of the diseases which require amputation rarely fail of producing a reaction to a greater or less degree upon the internal organs, and of thus giving origin in the viscera to abscesses, tubercles, ulcerations, indurations, and numerous other morbid determinations, (foyers morbides,) whose exact appreciation or detection is far from being always an easy matter.

§ V.

It is well nevertheless to remark that the debility which is found to exist in certain patients, is not in itself an absolute counter-indication to the operation. All observers know that it is not in the strongest subjects, and those who have the greatest appearance of health, that amputations succeed best. A certain degree of exhaustion produced by protracted pain, even diarrhœa itself when it is not kept up by any internal organic lesion, are in general favorable rather than unfavorable conditions. It would seem that in the first case the organization in possession of its whole forces, revolts at the mutilation which it has suffered; while in the other, the affection upon which it had exhausted all its resources, being removed, it has no other task to perform but to dissipate the subsequent disorders which it was not in its power to prevent.

§ VI.

When we have under consideration *recent traumatic lesions*, there may be a number of serious wounds in the same patient. Ought we then to amputate? and if there are several limbs to be removed, should all this be done on the same day? Bagieu relates that in a man who had both legs crushed, it was decided upon to remove the one most injured first; but that by mistake the other was taken off and the bad one got well! I amputated the leg of a man who had just fallen from a second story. He died on the fourth day with a laceration of the liver, (avec le foie déchiré.) In another case of wound it was proposed to amputate both legs; I objected to it. After death it was found he had twelve ribs and six of the verte-

bræ fractured ! If the two hands or two feet are the only parts wounded, we may amputate them immediately. Though the accompanying wounds are not in themselves mortal, still we should amputate. If other parts seem too seriously compromised, then wait and do not amputate immediately.

ARTICLE II.—THE PERIOD TO AMPUTATE.

In the last century surgeons were zealously occupied with the question whether after severe wounds by fire-arms or otherwise, it was better to operate immediately or to wait for the constitutional reaction. Faure, (*Prix de l'Acad.*, t. II., p. 337, et *Mém. de l'Acad. de Chirurgie*, t. II., p. 323, 1819,) Boucher, (*Mém. de l'Acad. de Chir.*, t. II., p. 199, 1819,) Bilguer, (*Abus de l'Amputation des Membres*, &c., traduit par Tissot,) Leconte, (*Prix de l'Acad. Roy. de Chir.*, t. III., p. 357–367,) Schmucker, (*Richter, Biblioth. Chir.*, t. IV., p. 1,) and De la Martinière (*Mém. de l'Acad. de Chir.*, t. IV., p. 133) particularly discussed this question during the controversies that took place. And although almost every surgeon since that period has treated of it, no one has yet been enabled to come to an absolute decision.

§ I.

The partisans of immediate amputation, among whom we must reckon Van Gescher, (*Necessité de l'Amputat.*, &c., 1767, in Dutch,) Fabre, (*Differents Points de Physiol.*, p. 279,) Briot, (*Prog. de la Chir. Milit.*, p. 189,) M. Durand, (*Thèse No. 198, Paris, 1814*), M. Jacquin, (*Thèse No. 54, Montpellier, 1831*), and M. O. Gouraud, (*Demonstr. des Princip. Opérat.*, 1815,) maintain that immediately after the wound the patient is found in the most favorable conditions possible. There is then, say they, no fever, suppuration or inflammation; the affection is entirely local; while at a later period the swelling of the limb, often gangrene, a violent reaction, tetanus, and a thousand other accidents may cause death before we have the opportunity to amputate. Even though this primary reaction may be calmed, the copious suppuration, and the separations of the muscles and the fistulous passages which may have been established together with the induration and disorganization of the tissues, ordinarily render the operation of a more serious character.

§ II.

To sustain their position, the partisans of *consecutive amputation*, among whom are to be ranged, Mehée, (*Inutilité de l'Amputat. des Membres*, Paris, 1800,) Lassus, (*Trad. du Traité des Fract.*, de Pott, p. 181,) M. Delatouche, (*Amputat. dans les Cas de Fract.*, etc., Strasbourg, 1814,) and Leveillé, (*Soc. Méd. d'Emul.*, t. V., p. 192,) maintain, on the contrary, that in the first moments the organism is too intensely disturbed, and under the control of a commotion too vio-

lent to admit of the possibility of success from any operation whatever, and above all that we run the risk of sacrificing limbs which it would have been easy to have preserved; whilst after having combated the first symptoms, should amputation become necessary, we have at least nothing to reproach ourselves with.

Besides that the question under this form is misplaced, the two opinions, taken literally, appear to be equally remote from sound practice. When amputation becomes absolutely indispensable, there is no doubt that it is better to perform it promptly than to put it off, and Faure, himself, (*Prix de l'Acad. de Chir.*, t. III., p. 337, edit. 1819,) who defends with so much zeal the cause of consecutive amputations, does not take opposite ground to this opinion. Bagieu (*Exam. de plus. Quest. de Chir.*, t. I., p. 137, 12mo.) and Leveillé have in this respect gone much farther than him. On the contrary when there is any chance of saving the limb, and its destruction is not inevitable, we may temporize and resist the general symptoms, reserving our decision to amputate, after the reaction is subdued, to those cases only in which we cannot obtain a cure by any other means.

§ III.

On examining the subject more closely, it is also evident that Faure has not treated the question in a proper point of view. It is true that his ten cases of wounds all of them had fracture; the first, the ninth and tenth, in the leg; the second in the thigh; the third in the knee; the fourth and fifth in the fore-arm; the sixth in the humerus; the seventh in the metacarpus; and the eighth in the heel; but the wound from the fire-arms was not sufficiently serious in any of them to extinguish all hope of saving the part. In regard to these cases the difficulty was to know whether amputation was indispensable, and not whether it should be performed at an earlier or later period. The result about which this surgeon made so much noise, does not therefore in any manner prove that amputation, when once admitted to be necessary, is less dangerous after than before the access of the general symptoms. We may, in fact, deduce from it a totally opposite conclusion. What, in truth, did he gain by thus temporizing? Nine out of his ten patients were reduced to the necessity of losing a limb, and that after five or six weeks of severe suffering, and after running the greatest danger of losing their lives. To say that if they had been amputated immediately they would not have recovered is altogether a gratuitous assumption. Reason, on the contrary, shows that these men who had such strength to resist so many causes of death, would have been much better cured if they had been operated upon at the beginning, and their recovery would probably have been completed, when, by the method of Faure, they were still under the anticipation of the operation.

§ IV.

In admitting that secondary (secondaires) operations succeed better than immediate, the Academy of Surgery have evidently been deceived. Against the calculations of Faure, which maintain that the success is in proportion of three to one, we may at the present time oppose the experience of a multitude of reputable persons, who have observed directly the reverse. Dubor (*Thèse*, Strasb., 1803. Larrey, *Clin. Chir.*, t. III., p. 518) affirms, that in the American war, the French surgeons, by deferring amputations, lost almost all their patients, while the Americans, by amputating immediately, saved almost all theirs, without scarcely an exception. In the affair at Newbourg, Percy (Gouraud, *Oper. cit.*, p. 8) performed ninety-two immediate amputations, and cured eighty-six of them. M. Larrey (*Ibid.*, p. 8) cured twelve out of fourteen. Out of sixty wounded in the naval action of Jan. 1, 1794, and who were amputated immediately, two only died, (Fercoc, *Lettre à M. Larrey*, *Clin. Chir.*, t. III., p. 515.) After the battle of Aboukir, the eleven soldiers mentioned by Masclet, (*Lettre à M. Larrey*, *Clin. Chir.*, t. III., p. 517,) who were amputated in the first twenty-four hours, got well, while three others amputated eight days after, died. The English surgeons assert, that after the battle of Toulouse immediate amputation succeeded in thirty-seven cases out of forty-eight; while in those in whom the amputation was deferred, twenty-one died out of fifty-one. At the attack upon New Orleans, the proportions were still more favorable, for out of forty-five amputations of the first kind, seven only perished, while out of seven of the second, two only were cured. We learn also that after the battle of Navarino, out of thirty-one immediate amputations, M. del Signore (*Archiv. Gén. de Méd.*, t. XXI., p. 298) lost but one; while out of the thirty-eight that he amputated in the twelve following days, he saved but twenty-five.

§ V.

Finally, the events of 1830 enabled us to corroborate the same facts at Paris. One hundred amputations were performed, thirty-four at the Hôtel Dieu, fifteen at La Charité, twenty at Gros Caillou, thirteen at Beaujon, six or seven at St. Louis, four or five at the Maison de Santé, three at the Necker, one at the Hospital of the School of Medicine, one at St. Méry, and five at La Pitié, and in all these places it was observed that immediate was more successful than consecutive amputation. Almost all of the first kind succeeded, while a great majority of the other kind had a fatal issue. The service of M. Roux, the wards of M. Larrey, of M. Richerand, M. Marjolin, and Dupuytren, gave proof of this assertion, though with the last the difference was less marked. The two cases also at La Pitié, in whom I deferred the amputation, died. Nevertheless Sommé, who after the battle of Antwerp, performed

five immediate and three consecutive amputations, lost two of the first and saved the three last; but what a difference was there also in the gravity of the wounds! In Holland, M. Kerst, who has decided for consecutive amputation, because of sixteen amputated in the first twenty-four hours, eight died, while of twenty amputated after fifteen to twenty days, four alone perished—and who admits no other cause of the difference of result in these two series than that of the period at which the amputation was performed—finds a sturdy antagonist in M. V. Onsenort, who, though a countryman of M. Kerst, gives the preference to immediate amputation.

Though secondary amputation should even succeed as often as it fails, it would be no reason for giving it the preference; it would be required, moreover, (and which is not the fact,) that immediate amputation, in itself, should offer fewer chances of success. The fundamental argument of the partisans of temporization, to wit, that a multitude of mutilated persons would have been enabled to save their limbs, if the surgeon had delayed, is, as I have already said, more specious than solid; for we can reply to them, that a goodly number of the other cases would be *living with three limbs*, if, in delaying the operation, they had not *suffered them to die with four*.

§ VI.

Though experience had not spoken, who could be made to believe that a simple, regular, and smooth (unique) wound, could be more dangerous than those wounds from fire-arms which, accompanied with fracture of the bones and crushing of the soft parts, require amputation? The pain, too, of the operation, can that be weighed in the balance along with those that patients, not amputated, every day suffer, and which are reproduced upon the slightest movements, or from examinations of the wound, dilatations, and the numerous incisions we are obliged to make to extract the splinters, moderate the inflammation, or give egress to the morbid discharges? In fine, who would have the temerity to maintain that, in this last condition, the wounded patient is not a thousand times more exposed to phlebitis, purulent infection, tetanus, and all the different kinds of visceral inflammation, than if an amputating wound had been substituted for the serious lesions he was suffering under?

And, after all, it is not at the present day that the doctrine of immediate amputation has been promulgated. Surgeons like Lecomte, Thompson, Heunen, MM. Larrey, Gouraud, and Guthrie, in opposing the ideas of Bilguer, Faure, Hunter, Percy, Lombard, and Leveillé, have done nothing more than to confirm or to establish, beyond the possibility of dispute, the justice of the assertions of Duchesne, who wrote at Paris in 1625, and also those of Wiseman, Le Dran, &c.

The advantages of this practice being now undoubted, the only question is to know at the very first whether an amputation is or is not necessary; which excludes it then from the category of

the diagnosis or indications? It is from having been constantly wandering from this point, that the question has remained so long undecided, and that it so frequently becomes the subject of controversy.

§ VII.

Upon the whole, therefore, amputation should be performed immediately; that is, in the first 24 hours, and before symptoms of reaction have commenced; in a word, as soon as possible, so long as there is no other chance of curing the patient. The stupor and insensibility (*engourdissement*) which are observable in some cases of wounds, is not by any means a positive counter-indication. A Swiss, whom I saw at the Hospice de Perfectionnement, July 27, 1830, with the thigh shattered (*broyée*) from a ball, and who I advised should not be operated upon, was amputated by M. P. Guersent, and did exceedingly well. We are not to abandon any cases but those that seem to be without any resource. It is for the skilful surgeon to decide what are the accidents which require delay. In doubtful cases, we defer; but if afterwards amputation becomes indispensable, we should be aware of the fact that it scarcely ever succeeds if performed during the severity of the symptoms, when the affection is not completely localized, and signs of phlebitis or infection have made their appearance. It is then especially that the viscera and all the functions should be thoroughly examined, seeing that the reaction which we had hoped to have had it in our power to subdue, often leaves in the system purulent depositions (*foyers*) which would be certain to endanger the success of the operation. These various remarks are as much applicable also to amputations rendered necessary by causes other than those of fire-arms, as to those of which we have been speaking.

[*When to Amputate.*—Sir George Ballingall (*Outlines of Military Surgery*, Edinburgh, 1844, p. 337) makes a remark of great value, which, though it appertains more exclusively to military surgery, has now (in the present frequent and dangerous use of fire-arms in our own country, on all occasions, civil as well as military, as in street-fights, broils, &c.) become of every day practical value, though apparently hitherto overlooked. It is the well-established fact that, in gun-shot wounds from balls, there is generally an *extensive comminution and splintering of the bone*, which is split and shivered, cracked and fractured, in all directions—chiefly, however, longitudinally, and not unfrequently to the distance of six inches, as in the tibia, &c. Numerous specimens of these are in possession of Sir George Ballingall, and he deduces from it the rule in practice, that full allowance should always be made, in cases of this kind, for the extent of this comminution, when about to amputate or exsect, or where the joints are laid open. The comminution, and also the calibre of the aperture, as is well known, are always greatest at the place where the ball makes its exit, (*Ib.*)

This Surgeon, also, presents some rather new, and certainly im-

portant, rules, as gathered from his great experience, both in military and civil hospitals, in relation to the *time* when amputations should be performed. He is satisfied that, in civil hospitals, *primary* amputations, *i. e.*, those that are performed at once and before reaction has commenced, do not do so well as in military hospitals; and the distinction he makes, founded on the different action of the moral causes in these two different states of circumstances, seems to us perfectly just. Thus, the soldier is ordinarily of far more robust health, and not only comes perhaps out of a filthy barrack-room into a clean, airy, well-regulated and uncrowded hospital, which thus improves his tone of health and increases his chances of cure, but has his mind at rest also as to his situation after amputation, as he knows a pension is then provided for him. Different is the condition of the laborer, for example, from the country, who, from a perfectly pure air, immediately experiences the deteriorating influence upon his health, on entering a civil hospital in a city, (as is remarked also by our author, M. Velpeau, see vol. I., *supra*.) and as is familiarly known, however clean and well-regulated the hospital may be, is almost always attacked under this change of his customary food, air, &c., with a species of febricula or, perchance, fever, which Sir G. Ballingall appropriately denominates a *seasoning*, and which he says, notwithstanding the reaction which is superadded to this by the amputation itself, should not deter us, in most cases, from proceeding at once to the operation, and thus take our chances for a favorable result from this combination of the *symptomatic* and *house fever* together. But few surgeons, however, would venture to go so far. Dr. Cormack (*Lond. & Edinb. Month. Journ.*, Dec. 1844, p. 1046) thinks the patient should be allowed first to go through his seasoning fever, especially if there has been a *rigor*.

As to what are called *intermediary* amputations, in contra-distinction to primary and secondary, *i. e.*, those during the existence of the constitutional reaction, they are *compulsory*, and not the time of choice which any surgeon would prefer.

Secondary amputations, however, or those performed after the inflammatory and febrile action have subsided, and when suppuration has commenced, are, as is well known and as has been fully discussed in the text of our author, (M. Velpeau,) always preferred, by some surgeons, to those that are called primary.

Sir G. Ballingall thinks the relative proportion of deaths and successes, from both primary and secondary amputations, and an accurate statistic also of the co-operating influences, such as those of the air, climate, constitution, the moral effect of victory or defeat upon an army, &c., would throw valuable light upon this subject. T.]

ARTICLE III.—OF THE PLACE WHERE THE AMPUTATION SHOULD BE PERFORMED.

All amputations have been divided into two great classes : those

that are performed on the body of the limbs, take the name of amputations in the *continuity*, (dans la continuité;) the others are nothing more than *disarticulations*, and are distinguished by the title of amputations in the *contiguity*. Amputations, moreover, are performed in a place of *election*, or one of *necessity*, according as the practitioner is free or forced by the disease to act on one point rather than on another. Upon this subject we can scarcely lay down other than extremely uncertain rules, for there are none of them that are not liable to numerous exceptions. Thus, it is not always correct to maintain that we ought to perform as far from the trunk, and remove as little of the parts, as possible; or that we should make choice of the place that is smallest, and is the least bulky.

§ I.

It is the same with the rule which prescribes that we should always amputate *above the diseased tissues*. Fatty degeneration by no means exacts the removal of the parts involved in it, since it may be of some advantage to preserve them; being the usual result of an alteration in hard parts, this as well as the fistulous passages and the purulent tracks, disappear as soon as the cause has been removed. It is sufficient, in such cases, to make the section of the bone above the part where this itself has undergone an alteration, without being at all disquieted by the state of the soft parts, especially if the case under treatment be the thigh or the upper extremity.

§ II.

On this subject, the *nature* of the disease is to be considered as well as its seat. If the question be that of immediate amputation in consequence of shattering or extensive damage to the limbs, or wounds from fire-arms, or gangrene, inflammation, and suppuration still advancing, or cancerous tumors, the instrument should be carried as high up above the apparent seat of the evil as the importance of the organ will allow. If, on the contrary, the disease which requires amputation is a gangrene defined, a necrosis, caries, suppuration, fracture, compound dislocation, wound of an artery, a division from a cutting instrument, or a strangulation, and that the morbid process which has resulted from it, is purely local, and has no disposition to extend higher up, we may, without any impropriety, take away that part only which has been actually disorganized.

§ III.

After *traumatic lesions*, it is generally advised to amputate at the articulation, or in the continuity of the bone above it; the accidents which, under such circumstances, supervene after amputation, being most usually imputable to the cracks (or splits—*félures*) which

extend sometimes to the spongy texture of the upper articular extremity of the bone which has been broken. M. Kerst remarks that the fissure is always made in the direction taken by the projectile. Following this indication, he has also, in cases where the wound has been made from above downward, been enabled to amputate successfully at the distance of some few inches only above it.

ARTICLE IV.—PREPARATIONS.

§ I.

The attentions, physical or moral, which we should give to the patient, the preparations to which it is proper he should submit before an amputation, are the same as for every important operation, and vary, moreover, according to an infinity of circumstances. Any time, season, hour of the day or night, may be selected for the performance of amputations, as well as for every other operation of urgent necessity. Generally, however, the morning is preferred if we are allowed to delay, and this because it is more easy to watch the patient during the remainder of the day, than if he had been operated upon at nightfall.

§ II.—*Dressings*, (appareil, vid. Vol. I.)

The instruments required to perform amputations that are the most complicated, are a tourniquet, a garrote, a pelote provided with a handle, (pelote à manche,) or other articles suitable to arrest temporarily the current of blood in the limb; knives of different lengths, a straight bistoury, a convex bistoury, a saw with spare blades, (de rechange,) a dissecting forceps, curved and straight scissors, cutting pincers, (tenailles incisives,) erignes, suture needles, and a tenaculum. For the immediate dressing, (le pansement,) we require single, double, triple, and quadruple waxed threads, of which the ligatures of different length and thickness are to be formed; strips of adhesive plaster, lint in the rough, (charpie brute,) in small balls (boulettes) and plumasseaux, (see Vol. I.) long, square, and also other shaped compresses; bandages of linen, and sometimes, those also of flannel. We must also have agaric, [or spunk or punk. T.] sponges, and warm and cold water in different vessels; a small quantity of wine, vinegar, and cologne water; a taper, with coals, in a chafing-dish, and a few cauteries, upon the supposition that they may be required.

A. Among these objects there are some which demand every attention from the surgeon. Thus the length of the *knives* should be in proportion to the size of the limb which is to be removed. Those of Wiseman and many of the ancient surgeons had the form of a sickle, for the purpose of dividing at once as much of the soft parts as possible. These curved knives, in general use for many centuries, and which are still employed by M. Onsenort for

disarticulating the shoulder, have been entirely laid aside since the time of Louis, who clearly pointed out their inutility and disadvantages. At the present day they are made perfectly straight, terminating in a blunt, wide point. Others, on the contrary, are rounded at their extremity. There are some, also, that are made very sharp at the point, having at the same time but little breadth. (M. Weinhold, (*Bull. de Fér.*, t. I., p. 140,) who, in order to complete the whole amputation with one instrument, invented a knife-saw, (*couteau-scie*;) has just been surpassed by M. Cazenaud, (*Rév. Méd.*, 1838, t. II., p. 442,) who possesses a *citexciseur* by which limbs are amputated at a single stroke, as was already done at the time of Botal!) The best amputating knives, however, are those whose cutting edge is slightly convex, as recommended by Lassus, and whose width is a medium between the knives adopted by the members or pupils of the ancient Academy of Surgery, and those of some modern surgeons. Their point is neither too acute, nor is it rounded off square, (*carrément*;) so that it does not become necessary to give to their heel a salient angle in front of the handle which sustains them.

B. The *saw* is an instrument which has undergone still greater variations than the knife. It is important that it should have so much weight, as to require only to be drawn upon the bone, at the time it is in action. Its blade should be properly made tense (*tendue*) immediately before the operation, have a slight degree more of thickness at the teeth than near its back, and a range sufficiently prominent (*un chemin assez marqué*) to enable it in penetrating to have a free and easy movement. This range (*chemin*) is given to it by the manufacturer in disposing of (*en déjetant*) the teeth alternately to the right and left. M. Guthrie recommends arranging these teeth upon two parallel ranks, so that in one their points incline forward, and in the other backward, in order, he says, that they may penetrate as well in advancing as in receding. This modification is not adopted with us. The saw used in England since the time of Pott and Hey, being very light, is more easy of management, (*à conduire*;) but to be well-handled, it exacts more practice than the French saw. (The one that Brunninghausen (*Operat. cit.*) claims to be the inventor of before Heine, unites according to the author, the qualities of the ordinary saw with the advantages of that of Pott. The turning saw (*la scie tournante*) of M. Thall (*Archiv. Gén. de Méd.*, t. I., p. 268,) is still of less importance. This, however, is not an essential matter in an amputation.) In cases of necessity, there is no kind of saw that may not serve our purpose. Victor Moreau performed his first exsection of the tibia, in 1788, with a joiner's saw, and M. Nève was compelled, M. Champion writes me, to make use of the same tool for an exsection upon the body of this bone.

Be that as it may, it is well in the order of regular surgery, that the saw should always have one or two spare blades; this is a rule which Fabricius of Hilden was induced to adopt, from having been forced to leave an amputation unfinished, until a second

saw could be procured for him, to replace the one he had broken. As to the other articles of the dressings, I shall return to them in speaking of their special applications, or of amputations in particular.

§ III.—*Position of the Patient.*

In hospitals, we generally carry the patient to the amphitheatre, or to a ward specially appropriated for operations, (See Vol. I.) We there place him upon a table more or less elevated, and provided with mattresses and folded sheets, (*alèzes*;) in certain cases, he is simply seated upon a chair properly arranged. Out of public establishments, we may also select a particular locale, but in general, we operate upon a bed or a chair in the sleeping apartment.

§ IV.

The *assistants* (Vid. Vol. I.) should each of them have a particular duty assigned to them, and that properly understood beforehand. One of them is charged with compressing the artery. For this purpose we generally select the strongest and tallest, or the one who has the most coolness and intelligence. A second embraces the limb near its upper part, in order to draw up the flesh. The third supports and fixes the part that is to be removed. A fourth is charged with handing the instruments, as they are required. Others seize hold of those various parts of the body, whose movements might interfere with the operator.

§ V.—*To suspend the Course of the Blood,* (See Vol. I.)

Amputation of the limbs is the operation in which there is the most imperious necessity of provisional hemostatic means. All that I have said of these means, and of the mode of using them, (vid. the preceding and present vol.,) must be borne in mind here. Compression with the fingers or hands does not prevent our having recourse to the garrote or tourniquet. "The garrote, (says M. Champion,) is my favorite means of suspending the course of the blood, because it succeeds better than any other, and because it benumbs the limb." In a feeble subject it becomes a matter of consequence to prevent even the loss of a small quantity of blood; in the country, and where assistants cannot be had, it becomes indispensable; and is also a preventive precaution against consecutive hemorrhage when we are separated some leagues from our patient. "I have seen," says the same practitioner, "the only assistant who was capable of compressing the femoral artery with a pelote, in a case of amputation of the thigh, faint away during the operation, so that the patient would have been exposed to the greatest dangers, if I had not taken his place." The perforated plate of the garrote exposes the ligature to be cut by its edges and I prefer a piece of strong leather. Loder says a single tourniquet is insufficient when

the extremities are thin; otherwise we should have to make too violent a pressure. The garrote, properly applied, in no way interferes with our preserving a sufficient quantity of skin to unite the wound.

CHAPTER III.

OPERATIVE METHODS.

ARTICLE I.—AMPUTATIONS IN CONTINUITY.

Amputations in the continuity of the limbs, which were overlooked in the time of Hippocrates, and almost the only kind since in use, during a long succession of ages, are still, at the present time, the most common; they are performed in three different ways, but principally by the circular, or flap operations.

§ I.—*The Circular Method.*

When we amputate by the circular mode, we have to look successively to the division of the skin, the section of the muscles, that of the bones, the hemostatic means, and the dressing of the wound.

A. *Division of the Skin.*—Celsus, (*De Re Méd.*, lib. VII, cap. 33,) Archigenes, (*Collect. de Nicetas*, p. 156,) Gersdorf, (Sprengel, *Hist. de la Méd.*, t. VII., p. 314,) Paré and Wiseman, (*Chirurg.*, etc., Vol. II., p. 220,) as Louis, (*Mém. de l'Acad. de Chir.*, t. II., p. 248,) Dupuytren, (*Leçons Orales*, t. IV., p. 298,) and many others have done since, divided the skin and certain muscles at the same stroke. It appears on the contrary, that Maggi (*De Vuln. Bomb. et Slop.*, etc., 1552) drew it up at first to sufficient extent to be enabled afterwards to cover the surface of the stump with it. This precept, nevertheless, was rarely followed in ancient times, and it is to J. L. Petit, (*Malad. Chir.*, t. III., p. 136,) to whom the credit is due of having caused it to be adopted.

I. After having circularly divided the cutaneous envelope of the limb, Petit caused it to be drawn up (*faisait relever*) by an assistant, or did it himself, to the extent of almost two fingers' breadth. Cheselden adopted the same mode, and nearly about the same time.

It was Alanson, (*Practical Observations*, etc., 1779,) as it seems to me, rather than Brunninghausen, who was the first that advised to dissect it, and turn it back from below upwards, after the manner of a kind of ruff, as M. Richerand, (*Nosogr. Chir.*, etc.,) and many

other French surgeons have done, at a later period. MM. Guthrie, (*On Gun-Shot Wounds, &c.*, 1815,) Graefe, (*Normen für die Ablösung grösserer Glieder*, etc., 1812,) &c., are of opinion that we may, without any impropriety, divide the aponeurosis and some of the muscular fibres at the same stroke; that we are thus more sure of thoroughly dividing the skin, and that this membrane then retracts with more facility. Hey (*Observ. de Chir.*, edit, 1814) and Langenbeck (*Biblioth. Chir.*, et *Nosol. und Ther.*) are of a contrary opinion.

II.—But what advantage is there in avoiding with so much care, the periphery of the aponeurosis and muscles? Whether the knife penetrates a little more or a little less, so long as the teguments are divided through their whole thickness, the remainder of the operation is rendered thereby neither more nor less difficult. Surgeons who, like Hey and M. Brunninghausen, (*Nouv. Biblioth. German.*, t. II., 1821,) prefer to have the stump completely covered by the skin, have laid it down as a principle that we must first measure the circumference of the limb, in order to preserve two inches of the integuments, as, for example, when we are to have a wound of four inches in width. Lassus (*Méd. Oper.*, t. II.) says he has followed this practice with success.

III.—In my opinion, precautions so minute are utterly useless. The best plan, when it is not our intention to cut down at once to the bone, is to divide with the amputating knife the different cellulofibrous bridges which attach the external envelope to the subjacent parts, while at the same time an assistant, or the operator, draws it back with considerable force towards the upper part of the limb. The pain is less acute, and the skin preserves a thicker lining than when turned up like a ruff, and nothing is easier than to raise it in this manner to the extent of two or three inches.

To effect this division the hand of the operator is passed under the parts, and in describing an arc he brings the knife upon the anterior surface of the limb. It is unnecessary to follow here the advice of Mynors, (*Practical Observations on Amputat.*, &c., 1788,) that we should incline its cutting edge from below upwards in order to divide the integuments by a sloping edge, (*en biseau*.) They are to be divided perpendicularly, while we draw the knife from its heel to its point, making thus as complete and regular a circle as possible. The hand is first turned in pronation, and gradually comes into supination, as it passes from the inner side of and then underneath the limb. If we prefer making this incision at one stroke, the hand turns insensibly upon the handle of the instrument so as to become gradually placed into forced pronation in terminating the operation. By this means we avoid that disagreeable and fatiguing twisting backwards (*renversement*) of the wrist that most surgeons make who do not wish to repeat their incision. With practice it is very easy to cut in the manner I mention; but I cannot see what great inconvenience there would be after having divided the skin upon the inside, outside and underneath, to withdraw the instrument, as a great number of French surgeons do, in order to re-apply it in front (*en dessus*) to unite by means of a

second cut the two extremities of the first wound. However, this is clearly a matter of option and not of necessity.

B. *Division of the Muscles*.—The section of the muscles more particularly is the point which seems to have occupied the attention of operators for a century past. At the time of Celsus the knife was carried a little higher up than the dead parts (*des parties mortes*;) the integuments and the whole thickness of the muscles were divided by the first cut; then the deeper muscles were detached and raised up in such manner that the bone might be sawed a little higher up, (*un peu plus loin*,) and these muscles afterwards be brought back upon the wound. This precept of Celsus, which Paré (*Œuvr. Complèt.*, liv. XII., ch. 30, p. 339) and Pigray (*Epitome*, p. 128–129) seem also to have adopted, was for a long time neglected; and Wiseman, J. L. Petit, and Cheselden, in making the division of the soft parts at two separate incisions, appear to have also themselves forgotten it.

I. It was Louis who clearly pointed out that the conicity (*conicité*) [cone-like shape. T.] of the stump, an almost constant result of the ancient methods was owing much more to the retraction of the muscles than to that of the skin. He therefore advised that the muscular layers should be divided by two successive cuts. With the first incision Louis divided the integuments and superficial muscles, causing them at the same time to be drawn back with as much force as possible, so as to favor their retraction by every means in his power. The deep layers were divided by a second cut; after which he made the section of the bone in the ordinary manner.

II. Le Dran (*Operations*, etc., p. 556) says: “With one stroke I divide the integuments and one half the thickness of the muscles; I then immediately cause the skin and flesh to be drawn back as much as possible, and make a second incision in a circular direction and upon a line with the skin (*de la peau*) where it is drawn back and divided. By this last I cut none of the skin, but only the muscles down to the periosteum.” This process has much resemblance to that of Pigray (*Epitome*, p. 128, in 12mo, 1615) or Celsus, and differs also as we see but very little from that of Louis. But it is this last author to whom the credit is due of having made its importance appreciated.

III. Valentin (*Recherches Critiques sur la Chir.*, p. 135) in his Critical Researches on Surgery, conceived that in order to divide the muscles it was necessary to put them successively in a state of extension at the moment when the knife was about to be applied to them; so that in the thigh for example, while the instrument was making its circuit, the limb, in adopting rigorously the rule of Valentin, would have to be thrown first backwards, then outwardly, then forwards, and finally inwards. This whimsical recommendation has not had and ought not to have any partisans.

IV. That of Portal (*Acad. des Scienc.*, t. CXXXVIII., p. 693, in 12mo, Ann. 1777) who reversing the precept of Valentin, recommends that in dividing the flexor muscles the limb should be held in the

utmost degree of flexion possible, and in a state of extension for the division of the extensor muscles, has not met with any greater success, though according to the author, Maréchal made use of it at the hospital of Strasbourg.

V. Desault (*Œuvres Chir.*, t. II., p. 547) combined the methods of Petit and Louis, that is to say, he recommended with the first of these authors first to divide and draw back the skin, and with the second to divide afterwards the superficial muscular layer on a line with the skin as drawn back, and to begin the section of the deep muscles at the line where the first had been retracted.

VI. After having dissected and turned back the skin, Alanson divided the whole of the muscles with a single stroke of the knife, taking care to direct the cutting edge of his instrument obliquely upwards, and to carry the point of it still more obliquely around the bone, with the view of obtaining a hollow cone whose base should be at the periphery of the wound. M. Langenbeck opposes this mode of proceeding, and Wardenburg, in maintaining the impossibility of forming a hollow cone, by following implicitly the process of Alanson, says that the knife held obliquely will of necessity take a spiral instead of a circular direction. Loeffler and Loder on the other hand endeavored to show that it was an easy matter to correct this tendency of making a spinal incision. It would appear that MM. Langenbeck and Graefe upon this point have misconceived the process of the English surgeon. In fact Dupuytren constantly employed this process at the Hôtel-Dieu with the greatest success. In order that the knife when carried obliquely may not deviate from the circular direction, it suffices to hold the handle properly, in proportion as the blade penetrates. Alanson moreover had observed that it was principally by means of its point that we hollow out (*creuser*) a cone through the muscles.

VII. In the process of Dupuytren an assistant forcibly draws back the soft parts; the operator holding the knife by the mode of Alanson then divides the skin and the whole thickness of the muscles with a single stroke; he then immediately (*sans désemparer*) brings back the instrument held in the same manner, upon the base of the fleshy cone which is left upon the bone by the retraction of the superficial muscles. This is done with extreme rapidity, and the result of the process is the formation of a perfect hollow cone, which apparently is exceedingly favorable to the union of the wound.

VIII. Bell (*Cours de Chirurgie*, trad. par Bosquillon,) after having divided the skin in the manner of J. L. Petit, and the muscles according to the method of Wiseman, passed his amputating knife between these latter and the bone, in order to divide their adhesions to the extent of about two inches, and in this manner to raise them with greater facility.

IX. All these processes have undergone other modifications which it is unnecessary to enumerate. The brevity of the text of Celsus has not prevented us from discovering in this author the origin

of the process of Petit, Louis and Bell, and even that of Dupuytren; but if it be questionable that any surgeon at that epoch followed a method at all comparable with those which are adopted in our days, it is not so with that which Pigray describes in the following manner:—"After having drawn the skin back (*avoir retiré la peau*) with the two hands, we must cut all the muscles around the limb above the disease; we then, with a *split compress*, (*compresse fendue*), raise up the divided muscle in order to saw the bone as high up (*le plus haut*) and as near the flesh as possible. The hemorrhage being arrested by caustics, astringents or the *ligature*, we bring back the skin in order to adjust it (*la fixer*) in front of the wound by *two stitches* of suture placed across it, (*passés en croix*.")

X. What is remarkable in all these processes, in appearance so different, is this, that when closely examined the most of them lead to the same results. Whether the skin and superficial muscles are divided with the first cut and the deep-seated muscles with a second incision after the manner of Louis; or we adopt, on the contrary, the rules laid down by Dupuytren; or whether the section of the soft parts be made in three stages, as Desault recommends, or in the manner Alanson made this division, or as Bell advises; so long as we take care to favor the retraction of the muscles, the bone is laid bare at two, three and four inches above the point where the incision commenced. The division of the muscles in amputations, in conformity with either this or that mode, is therefore a matter of much less importance than some people suppose.

XI. The process of Bell found, in 1829, a new champion in M. Hello, (*Thèse* No. 258, Paris, 1829,) formerly a naval surgeon, who recommends that it should in every case be substituted for the process of hollowing out the muscles (*de l'évidement*, *i. e.*, the process of the hollow cone. T.) and it is the one M. Champion usually adopts. In the trials I have made of it, it has in reality appeared to me that the muscles thus detached re-adhere with greater facility upon the front part of the bone, and that they could be more readily put in contact and kept approximated face to face, from the bottom to the borders of the wound, than by any other method. The only difficulty is that the operative process is a little longer and not so easy.

XII. With the view of preventing too great a shock upon the system, Faure (*Encycloped. Méthod. Méd.*, t. II., p. 210) seriously proposes to take off the limb by a succession of operations (*en plusieurs tems*) in three, four or five times for example, at 4 to 5 days apart; the first section to comprise a fourth of the circumference of the part, I suppose; some days after another fourth to be divided and so on to the conclusion. Faure even asks the question whether it would not be advisable to allow the first wound to cicatrize before proceeding to the second!

XIII. *The author.* The most rational, surest, and the most generally applicable method is as follows:—The skin is divided with the first cut without endeavoring too scrupulously to avoid the subja-

cent parts. An assistant raises it up while the surgeon divides the bridles which attach it to the aponeurosis or muscles, to the extent of two to three fingers' breadth. The knife now applied on a line with the retracted skin, passes circularly and perpendicularly through all the muscles down to the bone, or at least sufficiently near the bone for the superficial layer to be completely divided. The assistant again forcibly draws back the parts, and the surgeon, with a second cut, divides all the fleshy fibres of the deep-seated layer, at the point where this layer passes under the retracted extremities of the muscles that were first divided. Whether the knife be held obliquely or perpendicularly makes no difference in the final result; whether we go immediately down to the bone or merely to the deep-seated muscular layer is all the same. In both cases, however, we have to make a second division of those fleshy fibres most adherent to the bone and at two or three inches above the place of the first division. I divide the tissues perpendicularly, in order to obtain a cleaner (*plus nette*) section and a less extended traumatic surface.

C. The section of the muscles being completed, we raise them upwards by means of a *retractor*. Formerly they used for this purpose bags (*bourses*) of wool or linen, or pieces of leather, and even of metal. Fabricius of Hilden, Gooch, Bell, and Percy have severally extolled these objects; but at the present time we require only a simple split compress, with two tails for the thigh and arm, and three for the leg and fore-arm. The undivided portion of this compress is drawn back upon the posterior in preference to the anterior portion of the muscles, as M. Graefe recommends; while its two free extremities are crossed and turned back in front; the assistant who embraces the whole with the two hands thus draws the soft parts backwards, to protect them from the action of the saw. It is requisite, moreover, that this split compress, to which some surgeons, smartly reproved for it by Petit, have objected on the pretext that it interferes with the action of the saw, should be made of strong linen and wide enough to extend beyond the sides of the wound.

I. Before proceeding farther, most surgeons recommend dividing and carefully scraping the *periosteum*. It was with the back of their great sickle that Paré and Wiseman effected this denudation. Since that time the bistoury or the edge of an ordinary knife has been preferred for that purpose. Some with Graefe perform this from above downwards; others with Brunninghausen detach the periosteum in this manner from below upwards, or like M. V. Onsenort, form a flap with it in order to bring it down afterwards upon the section made by the saw.

II. All those *precautions are useless* as Alanson, MM. Guthrie and Cooper, and before them J. L. Petit and Ledran, had already pointed out. The motive in recommending them was to obviate the increase of pain, or to prevent tetanus, exfoliation and inflammation of the bone as well as the suppuration of the surrounding parts; as if the periosteum could have the least to do with the production of

such phenomena ! When it has been carefully separated, one of two things must happen :—1, The saw is applied a little higher up than the surgeon is aware of, and then it is the same as if no regard was paid to it ; 2, the saw is in reality applied to the denuded portion of bone, and in this case it would be strange if there should not remain higher up a small portion which has been deprived of its envelope. In fine, if the surgeon attains the object he has in view the precaution is injurious, and if he fails, it is, to say the least, useless. He must confine himself, therefore, to detaching carefully the fleshy fibres with the knife or the bistoury.

D. *Section of the Bone.*—Having done this, he embraces the limb with his left hand, placing the thumb immediately above or below the point which is to sustain the action of the instrument. The saw, held in his right hand, is applied perpendicularly ; we first move it rapidly with short cuts until it has worked itself a passage ; afterwards, we draw it through the whole extent of its blade, pressing only moderately upon it. So long as it has not yet made its way through the thickness of the bone, we may move it with rapidity ; but as soon as it has nearly completed the section, we must proceed with the utmost degree of caution. It is at this moment that the two assistants who are holding the two opposite portions of the limb, must redouble their attention in order to keep these in their natural direction. If the assistant who holds the diseased portion, lowers it, the bone almost unavoidably breaks before being entirely cut through ; if he raises it, on the contrary, the progress of the saw will soon be arrested, and the operation thus rendered more difficult. It is necessary that the operator should make himself familiar with handling this instrument, and when he uses it he should take care not to incline it either in one direction or the other. By attending to all these precautions, the bone is usually sawed off neatly. Nevertheless, if any points or roughnesses remain upon the extremity, they should be immediately removed with the cutting forceps, (pincers incisives,) as is usually done, or what appears to me preferable, by means of a small saw, or when they are of considerable length, by using the same saw which has served for the amputation. The edges of the sawed bone are usually quite pointed and sharp. Some practitioners, indeed, as MM. Graefe and Hutchinson, have advised that these should be smoothed down with a file, or with the cutting edge of a strong, short scalpel, but this practice has rarely been imitated by other operators. Theory and observation unite, in fact, in showing its inutility.

§ II.—*The Flap Operation.*

The flap operation which Sprengel (*Histoire de la Méd.*, t. VII., p. 316) and Gagnier (*Thèse de Haller*, 1734, t. V.) seem disposed to ascribe to Celsus, to Maggi and other ancient surgeons, such as Paré and de Hilden, was not, as it is generally believed, proposed for the first time by Lowdham, in his letter to Young, in 1679. We

shall see farther on, that Leonidas and Heliodorus describe it with sufficient clearness. It consists in cutting at the expense of the soft parts one or two flaps, (plaques,) which enable us to close the wound immediately and completely. After Lowdham, this method was extolled and variously modified, by Verduin of Amsterdam, in 1696; by Sabourin, of Geneva, in 1702; and by Morand, De la Faye, (*Acad. Roy. de Chir.*, t. II., p. 243,) and Garengéot, (*Ibid.*, t. II., p. 261,) before the middle of the last century. At first opposed by Koenerding, (*Sprengel, Oper. cit.*, t. VII, p. 318,) countryman of Verduin, and by Heister and many others, it was soon defended again by P. Massuet, (*Amput. à Lamb.* Paris, 1751,) Le Dran, Ravaton, and Vermale. Since then, O'Halloran, Dupuytren, Roux, Guthrie, Klein, Kern, Langenbeck, Larrey, and a multitude of other surgeons, have frequently had recourse to it. Its history presents two epochs that are quite distinct; one that comprises all that was said of it in the last century; the other, that which belongs more especially to the present time.

A. *Appreciation.*—Lowdham (Young, *Currus Triumph.* è tereb., 1679; *Mém. de l'Acad. Roy. de Chir.*, t. II., p. 244,) maintains that the flap operation is more prompt and less painful, and that it exposes less to tetanus and hemorrhage than circular amputation, that it renders the ligature upon the vessels useless, prevents exfoliation, obtains a rapid cure, and allows of an extremely easy adaptation of an artificial limb.

There is a considerable number of these advantages that experience has not corroborated. In the first place we cannot see how the flap amputation can be less painful or be more certain to prevent tetanus than the circular method. Exfoliation is a rare occurrence, instead of being constant, as it was then believed to be. As the artificial limbs (*moyens prothétiques*) are not to be applied upon the apex of the stump, it is a matter of indifference in this respect, whether the amputation has been performed by one method or the other. In fine, it is easy to perceive that we cannot dispense with tying the vessels, and that the wound scarcely ever cicatrizes without suppurating for a greater or less length of time. Its immediate reunion, however, is an incontestible advantage; and did not the improvements of the circular method allow of our accomplishing in most cases the same result, there is no doubt that the flap operation at the present day would have been generally preferred. We must allow, also, that it generally enables us to avoid with facility the projection of the bones and the conicity of the stump, and to preserve as much of the soft parts as are necessary to uniting without traction the widest and deepest kind of wounds.

B. *Processes.*—The flap amputation is performed by two general methods, the one from without inwards, the other from within outwards. In one we divide from the skin to the bones, while in the other, we commence by thrusting the knife through the limb, so as to cut the flap from the root to its free border. If the first mode is more regular and sure, the second is more rapid and brilliant.

From *without inwards*, it is well to begin by dividing the integu-

ments with a single stroke; we then cause the assistant to draw them back, in order that with a second cut we may effect the division of the muscles a little higher up. In proceeding in this manner, it is easy to give to the flaps the form and dimensions desired, but the operation requires several stages, and is not as rapid. If we plunge through the flesh, *at first* the point of the instrument, in danger of striking against the bones, often wounds parts that we should have preferred to avoid, divides irregularly certain tissues whose exact (*nette*) section is a matter of some importance, and does not always allow of our cutting flaps as thick as they should be for the object we have in view. Nevertheless, this mode of operating has found in our times, especially in dissecting rooms, and among those who practise upon the dead body, numerous and intelligent partisans; but it is scarcely ever employed, any more than the preceding mode for amputation in the continuity.

In conclusion, too much importance, as I think, has been generally accorded to the flap operation. The wound which it causes has necessarily a much greater extent of surface than if it was circular. The muscles which this mode deems it so important to preserve, are exposed to various accidents. If they should be attacked with inflammation, they suppurate most abundantly, absorb the fluid like a sponge, and favor to a remarkable degree purulent infection and phlebitis. On the other hand, they scarcely ever become adherent (*se fixent*) to the apex of the stump in the centre of the cicatrix. By whatever mode we may proceed, it is the skin which finally becomes united to the cut surface of the bone, and the side of the flaps through means of the retraction of the angles of the wound, favors to a greater degree than any other method the protrusion of the bone.

C. The flap method moreover presents a number of distinct modifications. Lowdham, Verduin, Labourin, M. Guthrie, and M. Graefe, confine themselves to a single lower flap, which they bring up in contact with the bleeding surface. Vermale recommends cutting one on each side, and to make them by plunging the knife down to the spot where the bone is to be sawed. That we may not be deceived in regard to the length, he proposes, before we commence, that we should mark out with a red thread the point of departure and the point where we are to terminate. Ravaton and Bell, with one stroke of the knife, divide circularly the skin and the entire thickness of the muscles; another incision, which strikes upon the bone in front and behind, in a direction parallel to its axis, then allows of the separation of the two flaps, which are dissected off and raised up immediately after. The process of Vermale is at present the only one, or almost the only one, employed, even for the formation of a single flap. The mode of Ravaton ought not, in fact, to be followed. The circular incision which it first makes is altogether so much loss. The flaps cut out in this manner, square, have too much thickness at their apex, and interfere to a considerable extent with their immediate union. When, on the contrary, they are cut with slanting or bevelled edges, (*en bec de*

flute,) they adapt themselves to each other accurately, even though we neglect the rule laid down by Mynors, that the skin should also be divided in a very oblique direction at the expense of its deep-seated layers.

D. *Two flaps* should be preferred when we have it in our power to give them nearly the same degree of width and thickness, whereas, if we are unable to give to either one of them the proper dimensions, it is better to cut one only. If the wound or the disease which compels us to amputate should leave considerably more sound tissue on one side than on the other, and has thus in some degree indicated the character of the flaps in advance, we should avail ourselves of it. After having completed the section of the bone, we then equalise the fleshy parts in order to cover the stump with them. Nevertheless, it becomes necessary in this last case, in order to close the wound, that the flap, if there be but one of them, should have considerable length, and that it should be bent almost to a right angle and submitted to compression and tractions, which nevertheless endanger the success of the operation. With two flaps, on the contrary, one in front and one behind, as M. Walther (Rust's *Handbuch der Chir.*, t. I., p. 609) advises, the bleeding surfaces are adjusted to each other without the least difficulty.

E. Kirkland, who excises the two angles of the wound, and M. Larrey, who confines himself to slitting them afterwards (*après coup*) to the extent of half an inch, make in this manner a sort of flap operation out of the circular method. M. Sédillot has remarked that in most of the methods of disarticulations in which a flap is cut in terminating the operation, the knife almost always encounters a difficulty in getting below (*à s'engager*) the bones that are to be removed; the angles of the wound moreover being stretched and bridled, are thus jagged (*dentelés*) and cut to a greater or less depth by means of the instrument. To avoid this inconvenience, M. Sédillot incises at first about a third of the extent of the flap with the heel of the knife or bistoury, and afterwards experiences no difficulty in finishing the operation without injuring (*léser*) the angles of the wound. In the continuity of the limbs, at the thigh, the upper part of the leg, and at the arm or fore-arm, M. Sédillot cuts two small, short, rounded flaps, which are then raised up to complete the operation by the ordinary processes for circular amputation. We thus unite the advantages of wounds with double flaps to those of circular amputation, the bones being covered over in a proper manner, and prevented from projecting at the angles of the wound. I have recently, says the author, applied this method to the fore-arm, and obtained the most satisfactory results. We shall see, in describing amputations in particular, what are the cases which do not admit of this mode of operating. M. J. Cloquet has suggested that in certain cases, after having cut through the skin circularly, it would be better, instead of dividing the other soft parts in the same manner, to plunge the knife between them and the bones, in order to cut from within outwards as in the flap method.

Finally, Dupuytren, M. Larrey, and others have frequently endeavored to combine the ovalar with the ordinary flap operation, by commencing with the division of the skin from without inwards, and terminating with the division of the muscles from within outwards.

§ III.—*The Ovalar Method, (méthode ovulaire.)*

The ovalar method, though more recent than the two others, and already described in the commencement of this century by Chasley (*Rust's Handbuck der Chir.*, t. I., p. 593) and M. Langenbeck, (*Thèses de Paris*, 1803,) and by Lebas, (*Bull. de la Fac. de Méd. de Paris*, t. V., p. 417–420,) who explains it in a memoir, upon which Bèclard reported to the Society of the Faculty of Medicine, and afterwards by MM. Guthrie and Richerand, for certain kinds of amputation only, was not in reality introduced into practice until in the year 1827, by M. Scoutetten, (*De la Méth. Oval., ou Nouv. Méth.*, etc., Paris, 1827.) According to this last surgeon, its great advantage consists in always allowing us to cut from without inwards, that is, from the superficial to the deep-seated parts, as in the circular method, and of preserving also a sufficiency of the flesh and soft parts to enable us with ease to bring the lips of the wound into coaptation, as in the flap operation; so that it occupies, as he says, the middle ground between the two other methods, and is the link which either separates or unites them. It is certain, that by the ovalar method, we obtain a neat and regular division; that for the most part, we may preserve a sufficiency of tissues to undertake immediate reunion; and that there are but few points upon the limbs to which it is not applicable, unless it be in the continuity of such as present length enough to make the circular or flap method easy and sure. Its distinctive characteristic is to form a wound of an ovoid shape, as already pointed out by Lassus, in 1793, M. Chasley, in 1803, or 1804, and M. Langenbeck, in 1809, and on which account M. Scoutetten has given it the name which I have retained. It consists of two processes which differ but little from each other. In the one case, which is the most ancient, the operator begins by circumscribing a triangular flap in the form of an inverted V, a little under the place where he proposes to use the saw or to disarticulate the bone. After having depressed the summit of this triangle, and separated the two lips of the wound, he passes from above downwards, or from one side to the other, using the saw in amputations at the continuity, and the knife in cases of disarticulation, grazing the posterior and deep-seated surface of the bone, and terminating by uniting the two first incisions at the base of the V, where the vessels had been preserved. M. Scoutetten prefers giving at the very first a perfectly oval form to his incision; except that he takes care in passing under the plexus of vessels and nerves and near the point which is to form the larger extremity of the oval, to go no deeper at first than the tegumentary tissues. This is no farther important than that it gives a little more regularity

to the incision. The oval method has the advantage of uniting all that is most approved of, both in the circular and flap processes. I have frequently used it, but shall examine it more in detail in the chapter on *Amputations of the Joints*.

ARTICLE II.—AMPUTATION IN THE CONTIGUITY.

The perusal of the works of Hippocrates teaches us that there was a species of amputation at the joints, sometimes practised among the ancients. Galen and Heliodorus also speak of it in sufficiently clear language. The Arabs themselves were not ignorant of it, and Sprengel is evidently in an error when he says that, from the time of the Greek writers down to Munnicks, nobody makes any mention of it. Guy de Chauliac states positively that, “if the disease (la corruption) invades the immediate neighborhood of the joint, (jusque près de la jointure,) the limb should be taken off at the joint itself, by means of a razor or other instruments, and *without sawing*, (sans scier.”) Nor has Paré passed it over in silence. Fabricius of Hilden, speaks of it as a common process; and Pigray thus expresses himself upon this subject: “Some start objections to cutting in the joint itself, or near it, because of the nervous parts, (parties nerveuses;) nevertheless, the dangers from these are not so very great: *I have seen many such (amputations) which have done well.*” The labors of Ledran, Morand, Heister, Brasdor, and Hoin, therefore, have done no more than to revive this operation, by dispelling the prejudices with which the physiology of the middle ages had invested it. It is performed like amputation in the continuity in three principal ways, but more especially by the flat or the ovalar method. We shall see, farther on, however, that the circular method is perfectly applicable to it, and that this ought, in a large number of cases, to have the preference.

The advantages of disarticulation are, that it is more prompt and easy than amputation in the body of the limbs; that it does not require the section of the bones, is more favorable to immediate union, and enables us to preserve a longer stump. Its disadvantages, at least in a large number of cases, are: that it lays bare extensive osseous or cartilaginous surfaces; that it obliges us to carry the instrument upon the thickest parts of the bones, which are least abundantly supplied with soft parts, and to make use frequently of tendinous or synovial tissues for closing the wound; and that it also makes a solution of continuity, somewhat irregular: but it is not true, other things being equal, that it endangers, more than amputation in the continuity, as had been for a long period thought, nervous symptoms, tetanus, abscesses, purulent collections, and symptoms of general reaction. It requires but few instruments, and no necessity of such complicated dressings as are demanded in amputation in the continuity. A knife or simple bistoury are generally all that are needed to perform every step of the operation. So also have we less to fear from the conicity of the stump, the projection of the bones, or the retraction of the muscles. As the soft parts are

but slightly displaced, the adhesion of the flaps is obtained with facility, and the inflammation proceeds no farther than is requisite to secure immediate union. The division acting only on the skin, the cellular and fibrous tissues and some of the attachments of the muscles; inflammation, abscesses, and constitutional reaction, are in general but little to be apprehended. Though very large in appearance, the wound has in reality but very little extent; because the cartilaginous surfaces at the bottom of it, being deprived of all sensibility and wholly inert, take no part in the process of suppuration or inflammation. M. Kerst, professor in the military hospital of instruction at Utrecht, prefers, as a general rule, disarticulation to amputation in the continuity, because from the last we have to apprehend traumatic fever of a pernicious (*pernicieuse*) and intermittent character, together with inflammation of the veins in the sawed bone.

The dread which prevailed among surgeons of the last century, of wounding the inter-articular (*diarthrodiaux*) cartilages, exposing them to the air, and touching them with the instrument, is at the present day entirely dispelled. In place of all those precautions formerly recommended in order to avoid the articular surface, which constitutes the bottom of the stump, some modern surgeons go to the extent of advising that it should be wounded expressly. For example, M. Gensoul (*Thèse* No. 109, Paris, 1824) is of the opinion of Richter and Bromfield, that, in scarifying it (*la découpant*) with the point of the knife, we have a better prospect of cicatrization by the first intention. This practice, adopted also by some surgeons of Paris, and which is attended with no inconvenience, seems, nevertheless, to be sustained upon a position which is far from being demonstrated. In fact, it is incorrect to say, with Béclard and many others, that after amputation in the *contiguity*, [*i. e.*, in the joint, *vid. supra. T.*] the smooth face of the cartilage does not unite with the flaps, but remains free even after the final cure, unless by some means or another, inflammation has been excited. This can only take place by exception. Whether the instrument comes in contact with it or not, it nevertheless contracts, and that speedily, firm adhesions with the tissues that cover it; and it is as useless to scrape it with a scalpel as to cauterize it, in the manner practised in the time of Heliodorus. If the agglutination is not immediate, the cartilaginous surface, acted upon by the cellular granulations which are formed upon the bone, soon detaches itself, sometimes in fragments, sometimes in large pieces, (plaques,) at other times in the form of a shell, (*coque*,) and soon completely exfoliates, leaving exposed a vermilion-colored wound, which afterwards cicatrizes with great facility. In the contrary case it does not perceptibly change its appearance; it only loses its polish and becomes rugose, (*rugueuse*;) but a molecular action soon develops itself, erodes, (*miner*,) and insensibly dissolves it, until it has totally disappeared. Constituting the true epiderm of the bones, and consisting of a simple anhiste (*anhiste*) tissue, it cannot, with the attributes that belong to it, exist any longer than

while the articular movements are preserved. As soon as the living tissues rest permanently upon it, (*la touchent à demeure*,) the vitality of the bones, properly so called, begins to act upon it and to destroy it, by creating the cellulo-fibrous deposition, (*couche*,) which is the base of every sound cicatrix ; unless in its actual state of cartilage, (*véritable épichondre*,) it becomes agglutinated to the soft tissues, by becoming, as M. Champion thinks, organized and blended with them. By one mode or the other, the tendons, aponeuroses, nerves, and vessels, ultimately become firmly adherent upon the extremity of the stump, so much so, that the patient is enabled to move it with as much facility after the cure as before the operation.

When the articulation is surrounded with a large capsule, it is well to remove as much of it as possible with the bone, without however giving ourselves any great uneasiness about such part of it as may remain. In place of leaving the tendons hanging out of the wound, they should on the contrary be cut off as low down as possible, that their presence may not interfere with the immediate union. The incision into the fibrous and synovial sheaths, as recommended by Garengeot and Bertrandi, with the view of preventing their inflammation and the formation of purulent collections, is useless, and should not be practised unless there are particular indications for it.

The fistulas which sometimes follow amputations at the joints, are owing either to some point of the cartilaginous surface which has not exfoliated or become adherent to the flap of the soft parts, continuing to exude synovia ; or to one or more of the tendinous sheaths which have not closed, furnishing fluids of the same nature in quantities sufficient to become an impediment to the agglutination of the tissues. These difficulties are in general very easily overcome, and almost always without any serious consequences, by means of compression, stimulating injections, cauterization, &c. Moreover, amputations in the continuity are by no means absolutely exempt from such accidents. If, therefore, in amputating below the articulation we can remove all the disease, and at the same time preserve a sufficiency of tissues to close the wound, amputation in the continuity ought to have the preference ; on the contrary it is better to amputate at the joint than to go above it. On the other hand, if in amputating at the articulation we should incur the risk of not removing all the disease, we should renounce it and carry the instrument higher up. When in amputating in the continuity we are obliged to make the section of the bones too near the great synovial cavities, disarticulation is the preferable course. The danger of purulent arthritis is then too imminent not to justify the immediate sacrifice of the joint. All these questions, moreover, have been judiciously examined by M. Sédillot, (*Thèse de Concours*, 1836.) In conclusion, the extirpation of the limbs is not more dangerous than their amputation, properly so called, and it is the extent of the disease and the functions of the organ to be removed, which are to influence the surgeon in his preference for

one of these methods over the other, in the particular cases that present.

ARTICLE III.—THE DRESSING.

§ I.—*Hemostatic Means*, (hémostasie.)

To prevent the flow of blood after amputations, is one of those indications which has most engaged the attention of surgeons at every epoch; and what I have said of hemostatic means in treating of operations in general (vid. Vol. I.) are especially applicable to amputations.

A. At the present day we are no longer under the necessity of recommending to surgeons the remedy eulogized by Galen, of one part incense and a half of aloes with the white of an egg; nor the mushroom nor puff-ball (*vesse de loup*) vaunted by Van Horn, and revived by Vurtz, (*La Chirurgie*, p. 36;) nor Fowler's powder, nor hog-excrement, nor the powder of burnt agaric mentioned by Charmetton, nor the thrusting the arm into the bowels of a cock opened alive, after having cut off the wrist, as did that brute mentioned by F. Platter, (Bonet, t. III., p. 145, liv. 4, obs. 25;) nor the animal oil of Dippel given internally by Schulze, (Rondelai, *Hemorrh. Internes*, p. 90.—*Thèse de Paris*, in 8vo.) The hemostatic bladder, used by Gersdorf, (*Chirurgien d'Armée* in German, p. 63, 1527,) reintroduced by Wiseman and afterwards by Fabre, (*Essais sur divers Points de Physiologie*, p. 160, 1770.—*Recherches des Vrais Principes de l'Art de Guérir*, p. 531, 1790,) and on one occasion made trial of on the fore-arm with success by Frescarode (Fabre, *Recherches*, &c., p. 278, 1783) are equally useless. Nor has the reunion of the wound by flaps (*lambeaux*) and compression, which answered the purpose with Verduin and Sabourin, and which Kock has so much eulogized, and Smith employed, any longer to be discussed, even though we should combine with it like Garengéot (*Mém. de l'Acad. de Chir.*, t. II., p. 180; and tom. V., p. 263) a ligature on the principal artery. It is effectually the ligature or torsion that we must have recourse to after amputations, unless in cases altogether of an exceptional nature.

B. It was for a long time thought advisable to include a certain portion of tissue in the ligature upon each artery. If Fabre is to be believed, (*Oper. cit.*, p. 278, 1783,) it was Ferrand who first resorted in amputations to direct ligature upon the artery, (*à la ligature de l'artère immédiate*.) The author of a thesis upon surgery at that time also made the same remark. Desault (*Journ. de Chir.*, t. IV., p. 203) according to Bichat (*Eloge de Desault*, par Bichat, p. 43) had recourse to this means, Louis being present, at the Bicêtre in 1779, and before any other modern. Pouteau (*Ancien Journ. de Méd.*, t. XLVIII., p. 440, 1777) recommended also that the artery should be isolated on each side the ligature, in order to prevent accidents. Nothing analogous to this is in practice at

the present day. The tenaculum of Bromfield under this point of view has naturally carried us back without any disadvantage to the time of Avicenna ; the artery is to be denuded, (*écorché*), that is, stripped of the flesh that invests it, says the celebrated Arab, (*Guy de Chauliac*, trad. de Mingelouseaulx, t. I., p. 112 ; *Des Plaies*, ch. IV., *Quatrième Façon d'arrêter le Sang* ;) we then seize hold of it with a small hook, draw it gently outward, pass under it a thread of silk, and then tie it with a firm knot.

In order not to entrust to an inexperienced assistant the direction of the ligature, Brunninghausen (*Expér. et Obs. sur l'Amput.—Gaz. Méd. Chir. d'Ehrhart*, 1818, et *Nouv. Bibl. Germanique*, t. II., 1821, p. 51) makes use of a small fork (*fourchette*) with blunt points, by means of which he passes the thread above the artery, until the assistant has tightened the knot outside of the wound, and in a horizontal direction. As large as well as small arteries are to be tied, the author has had constructed a double instrument, the branches of which separate farther apart on one side than on the other, so that by means of the narrower extremity (*sa plus étroite extrémité*) we may also bring up to a level with the wound the arteries that have retracted too deeply, and likewise separate them from the nerves and other parts with which they may be united ; but the spring forceps (*pincés à ressort*) described in the article on torsion, (vid. Vol. I.,) and the *pincés-porte-nœuds*, as contrived by MM. J. Cloquet and Colombat, would be much preferable, if under such circumstances there should be any necessity of a particular instrument.

The ligatures required, also sometimes amount to a considerable number. Loder (*Bibl. Germ. Méd. Chir.*, trad. Franç., t. II., p. 94) relates that he was obliged in a case of amputation of the leg in an infant, to use sixteen before he could effectually arrest the hemorrhage. In another case he used nineteen, and several smaller arteries were included in the same ligature. The first case recovered in twenty-five days ; but in the other the flap, on removing the dressing on the fifth day, was found to have become detached. In other cases there is *no hemorrhage, and the ligature is inapplicable*, for we find no arteries, (Taxil Saint-Vincent, *Jour. Univ. des Scienc. Méd.*, t. —, p. 324.) I have elsewhere detailed (*Jour. Hebd. Univ.*, t. I. et II.) numerous examples of this kind. Zinc (Chalmail, *Recherches sur les Metastases*, p. 265) has seen this in the fore-arm, Chalmail (Chalmail, *Op. cit.*, p. 265) in the arm ; Leveillé, Briot, and all army surgeons have frequently made the same remark, (Gaultier de Claubry, *Jour. Gén. de Méd.*, t. XLVII., p. 238.) It is necessary that the ligatures should be very firm. Morand (*Opusc. de Chir.*, t. II., p. 268) on one occasion found that all the ligatures handed to him snapped, the threads, according to the author, having wasted away from their being so old. After this nothing is more embarrassing than ligatures that are too long ; fifteen inches is enough for each.

The blood arrested at first may afterwards reappear. Tetu (*Recueil de Méd. et Chir. Milit.*, t. XXII., 3 Nov., 1827) amputated

the fore and middle fingers with the corresponding metacarpal bones; in spite of the ligatures the hemorrhage was renewed an hour after, and a ligature upon the deep palmar arch (*crosse palmaire profonde*) became indispensable. Sometimes hemorrhage takes place from the end of the bone. In a case of this kind A. Petit (*Acad. des Sc., Paris, 1732, Mém., p. 39*) succeeded with lint in the mouth of the vessel. Hevin (*Pathol. et Thérapeut., t. II., p. 40*) used with advantage a plug of wax. In Loder's case of 19 ligatures, (*Obs. Méd. Chir., Jéna, 1794, dans Bibliot. Germ., t. II., p. 94*), the blood issued copiously from the medullary canal (*la moelle d'os*) of the bone of the leg. To arrest it he was obliged to use *eau d'arquebusade*.

We may be obliged to tie the veins. I have, says M. Champion, had to tie the femoral (*crurale*) vein which was throwing out blood in jets, (*par saccades*), in a case of amputation of the thigh, performed upon a man who had become excessively nervous from fear of the operation, and who, after it was performed, experienced prolonged paroxysms of suffocation, (*des suffocations prolongées*.) The same thing has occurred to me on three occasions; the ligature of the veins therefore after amputation, as I have already said, does not appear to me so dangerous as has been asserted. [On the method of *tying* arteries, &c., see Dr. Mott's remarks at the conclusion of this section of M. Velpeau's work, *supra*. T.]

§ II.—Disposition of the Wound.

Being now secure against hemorrhage, (*vid.* Vol. I.,) the surgeon has to attend to the dressing. It is now that the great question of immediate or secondary union presents itself. From the time that Lyon (Alanson, *Manuel Prat. de l'Amput.*, 1765) suggested to Park the idea of bringing the parts in contact (*affronter*) upon the centre of the stump, to obtain union by the first intention, and that Alanson brought the practice into vogue; from the time when, in accordance with the English surgeons and the flap method, M. Maunoir made himself the champion of it, immediate reunion has become so generally adopted that it is had recourse to after almost every kind of amputation. But I have elsewhere (see Vol. I.) treated of this subject too much at length, and its advantages and inconveniences, as well as of the different sorts of dressings applicable to amputations, (see same volume,) to make it necessary to recur to it in this place. I shall not, therefore, speak of it again except when treating of each amputation in particular. Surgeons, however, have not confined themselves to the adoption of these different methods separately; it has been proposed by some persons to blend them and to combine many of their stages, (*d'en réunir plusieurs temps*), with the view of profiting of the advantages of some and protecting ourselves from the inconveniences of others.

It is in this manner that O'Halloran (*New Method of Amput.*, 1765,) adopts the following modification, which, in his opinion,

ought to conciliate the suffrages of all in favor of Lowdham's mode of amputating. Instead of depending upon compression to suspend the hemorrhage, he advises, like Garengot, that we should tie the arteries with care, and in order to be sure of having no serious difficulty at the stump, he proposes that the dressings should be flat, (à plat;) that the flap should be left to suppurate for eight or ten days; and that we should then, as soon as it covered with cellular granulations, raise it up and adjust it properly to the rest of the wound. White (*Cases in Surgery, etc.*, 1770) and Paroisse (*Opuscules de Chir.*, 1806) assert that they have practised this mode in a great number of cases and with the most perfect success. For my own part I am convinced, from the trials I have made of it for the purpose of *secondary immediate union*, (réunion immédiate secondaire,) that with us it has not been properly appreciated, and that in a great number of cases it possesses incontestible advantages, (see Vol. I.) What O'Halloran added to the process of Lowdham, Bécлар proposed for that of Vermale, when the flaps are formed of tendinous parts, fibrous troughs, (coulisses or sheaths) and synovial sheaths.

ARTICLE IV.—CONSECUTIVE TREATMENT.—(Soins consécutifs.)

The patient being carried to his bed must be placed there in a comfortable position; a hoop (cerceau) is made use of to sustain the weight of the bed clothes, and to hinder them from pressing upon the stump, which latter is to be placed gently upon a cushion or upon a sheet folded in the manner of a *fanon* (vid. Vol. I.)

§ I.—*Position of the Stump.*

It is the practice invariably to have this part slightly raised, in order that the muscles may be relaxed, and also according to some persons for the purpose of counteracting the tendency of the fluids to gravitate (à se porter) towards the wound. There are in fact some advantages from it in this point of view so long as there is no suppuration. But in the contrary case we evidently thereby favor inflammation along the inter-muscular cellular passages, (trainées,) the denudation of the bones, phlebitis, the formation of abscesses and purulent infection. The wisest course therefore is to follow the advice of Hippocrates and Alanson, that is, to leave the stump, should the form of the limb admit of it, upon a horizontal plane, and even to place it upon an inclined one, as soon as the suppuration is about to be established.

§ II.—*Immediate Medication.*

A spoonful or two of pure wine might be proper to relieve the torpor or sinking temporarily produced by the operation; during the remainder of the day we give a few spoonfuls of some anodyne and mild anti-spasmodic potion; and for a drink, infusion

of linden, (tilleul,) violet, poppy, &c., sweetened with syrup. Except in patients who have been debilitated by long suffering, abstinence at first, in the opinion of most surgeons of Paris, should be rigidly adhered to. According to them, the most that is admissible is a little diluted broth, (bouillons coupé) until the general reaction has taken place. This is a practice which I have renounced for many years past. If the patient has an appetite, and the constitutional reaction is moderate, I give him broths the first day, a po-tage on the day after, and put him on the fourth part of his usual food (je le mets au quart d'aliments) on the fourth or fifth day. Unless it be the thigh or leg that has been operated upon, I change the patient as little as possible from his ordinary diet, and treat him as a convalescent.

§ III.

Furthermore, the *regimen* after amputations ought to be the same as after acute diseases, and all the greater operations, (see Vol. I.) If the patient is robust and sanguine, and the operation has been performed for a recent injury, and there has not been much hemorrhage, congestion (le réfolement) of the fluids is to be feared, and we may resort to bleeding and depletives. In France, the importance at this time of diminishing the volume of the blood to prevent internal inflammation, and the dangers of general reaction, has been greatly insisted upon. In Germany, England, and America, however, many operators follow an opposite course. Kock, on the very first days, allowed his patients coffee, wine, and even meats. M. Benedict affirms that the bleeding, instead of preventing accidents, favors their development. It is those who are the strongest and are the most sanguine, who best resist, he says, morbid causes, and in whom inflammations are most easily cured. Therefore, the more we debilitate persons amputated upon, and the more they are bled, the more are they disposed to become sick, and the more dangerous and difficult to treat are the inflammations with which they are attacked. The severe dieting and the copious bleedings, prescribed by some persons, and immediately after amputations, only become really serviceable at the moment when incidental (inter-current) diseases and local inflammations make their appearance, (see Vol. I.)

§ IV.

In ordinary cases, the *first dressing* should not take place until at the expiration of seventy-two hours, or of four days, or even sometimes five or six, as recommended by C. Magati and Monro, and as still practised in Spain. In general, patients have much dread of it. Once, in fact, it was to them a formidable affair. No precaution was taken to prevent the adhesions of the lint and compresses to the bottom or sides of the wound. Being performed upon the next or the second day after the operation, and consequently,

before suppuration was established, it was calculated to produce such severe pain as to leave an impression upon the minds of the patients as fearful almost as that of the amputation itself. In this respect, patients of the present day are agreeably disappointed. The pieces of linen besmeared with grease, (*les linges graissés*) which Bromfield (Alanson, *Man., etc.*, p. 33) was the first to introduce into practice, or the strips spread with cerate always render easy the separation of the other portions of the dressing. At the end of three or four days, the natural moisture and exudations from the wound have destroyed the adhesions which would have necessarily produced some traction, so that the first dressing causes no more pain than the subsequent ones. We should be on our guard, therefore, against imitating those busy-bodies (*commères*) who are found even in hospitals, and who, under the idle pretext of seeing what is going on in the stump, wish to have the dressings removed on the first day. We should not, however, hesitate in removing them if any accidents supervene, such as violent pains in the wound, erysipelas, swelling or hemorrhage. In summer, or when the bandage becomes saturated, and emits much smell, it may also be proper on the first or second days, to remove all the pieces which do not bear directly upon the wound, (see Vol. I.)

In dressing, an assistant takes charge of the stump, which he supports gently with his two hands, taking care not to give it the least sudden movement. The bandage and compresses, impregnated with blood and other fluids, are for the most part, glued together and hardened by drying, to such degree, that their removal sometimes becomes a matter of considerable difficulty. In such cases, if by saturating them with warm water we do not succeed in softening them, we must cut off the turns with a scissors. These first pieces being detached, we wet the lint freely with water, and remove only the outer pieces, should they still adhere too firmly. As soon as the wound is uncovered, it should be washed; we do this by squeezing gently warm water upon it, and afterwards cleansing it with fine linen or small balls of lint; after which, the dressing is reapplied as at first, to be repeated every day in the same manner.

If immediate union has been attempted, and no special accident has supervened, we defer to a still longer period this first dressing. Nevertheless, as it is rare that the agglutination at the first is complete at every point, it is likewise a rule to cleanse the stump on the third, fourth or fifth day. If no suppuration makes its appearance, and there should be no reason to believe that there are sinuses forming or appearing, (*qu'il se forme ou se prépare des clapiers*,) we should avoid meddling with the lips of the wound; at most, it is allowable to remove one of the strips of adhesive plaster to replace it immediately by another. In the contrary case, and when the plasters have become loose, they should be removed in succession, and the purulent and other matters, by means of gentle pressure, be encouraged to make their way outwardly. To detach these strips, they are to be raised successively from their extremi-

ties towards the apex of the stump, on which point they are not to be separated until at the end of the dressing; otherwise, were we to take them off from one side to the other without stopping, we should run the risk of destroying the adhesions which at this time are too feeble to sustain the least degree of traction.

§ V.

The *ligatures* ordinarily do not come away before the eighth or tenth day, and after they have, by means of ulceration, completely cut through the artery they embraced. It would, therefore, be improper to endeavor to force them away at an earlier period. But as soon as they delay coming away beyond that time, there will be some advantage in pulling upon them a little as often as the dressing is removed. Their retention is owing to their having been caught in some sinuosities, or from the knot having imprisoned some fibrous lamellæ as well as the artery. Their separation, moreover, is the more speedy in proportion as their application has been more directly made upon the vessels, (plus complètement immédiates.) Everything induces to the supposition that their presence ceases to be useful after the second or third day, and that there would be no impropriety at this time in disembarassing the wound of them, provided the thing was easy of execution. I have seen them after amputations of the arm or leg, come away on the third or fourth day without any inconvenience. Bonfils, (*Thèse de Strasbourg*,) who maintains that after the sixth day we should hasten their separation, proposes even that we should subject them to a sort of permanent extension; to carry out this object, which MM. Kluge (*Bull. de Fér.*, t. X.) and Law (*Ibid.*, t. XII., p. 234) have proposed to lay down as an axiom, they recommend that the knot should be tied outside and upon pieces of sponge. That we may not have to resort to what J. L. Petit (*Malad. Chir.*, t. III., p. 196) did, who was obliged to divide at the bottom of the wound a ligature that did not come away, and in order to avoid, also, drawing forcibly upon them at every dressing, as soon as the inflammation has subsided, as is recommended by Alanson, (*Oper. cit.*, p. 76,) M. Pierron (*Thèse* No. XII, Paris, 1824) proposes that we should subject them to a permanent torsion, which is to be increased daily; but it is not often that surgeons of the present day require any such means.

ARTICLE V.—ACCIDENTS.

The accidents which may succeed to amputations of the limbs are important and numerous. Some of them occur at the moment of the operation, and the others at a greater or less distance of time afterwards.

§ I.—During the Operation.

A. Hemorrhage.—In feeble subjects the loss of blood during the

operation is a thing calculated to give rise to serious consequences. It takes place sometimes before we have had an opportunity to tie the vessels, either because the tourniquet has been loosened or displaced, or from the assistant not making the compression properly, or because unexpected difficulties present themselves in seizing hold of the arteries. It is to avoid these difficulties that a suggestion has been made to place a ligature upon the principal artery of the limb before commencing the incision of the soft parts. M. Blandin gives an example of this practice, which is still followed at the Hospital of Beaujon, by M. Marjolin. M. Guthrie and some others have thought it more advisable to tie the arteries in proportion as they are cut. When the ligature is impracticable, our art possesses no other resources than mediate or immediate, and lateral or perpendicular pressure.

But there is *another kind of hemorrhage*, to which these means are not applicable: I mean hemorrhage from the veins, and which, nevertheless, is in some persons exceedingly abundant and sometimes alarming, being produced by the temporary compression preventing the blood from returning to the upper part of the trunk, or caused by some obstruction in the respiration. To arrest it, some persons have proposed to apply a ligature on the principal vein. Monro, Bromfield, Hey, and M. Guthrie are of this opinion. With us, we generally proceed in a different manner. We remove immediately everything which can produce any obstruction in the course of the blood through the limb. The patient is directed to make long inspirations, and the difficulty subsides almost immediately. I have already remarked, that a ligature upon the veins has nothing in it alarming, and that, in persons who have been amputated and who are already too much enfeebled, we must have recourse to it, if the other means do not promptly succeed.

B. The syncopes and swoonings which result from the hemorrhage, or the pain, or from the fright which the operation sometimes causes to the patient, require scarcely other than moral means, a spoonful of wine when they are anticipated, cold water, vinegar, or Cologne-water, thrown in the face or held to the nose, and all the other means generally resorted to under such circumstances, and which require no further detail.

C. *Spasms*.—It is not uncommon, immediately after the operation, to see the stump take on a *trembling* which it is difficult to restrain—a sort of convulsive or spasmodic movement, which also requires some attention. Under such circumstances we endeavor, suddenly and as strongly as possible, to divert the attention of the patient, and to inspire him with courage; we make him seize hold of his leg himself at its upper part, or, should it be thought more advisable, cause this to be done by an assistant, with both hands, until the dressing is finished. In general, this symptom continues but a short time, and disappears in a few minutes. It is generally relieved by compressing the muscles with force upon two different circles of the stump. Nevertheless, if it should seem disposed to continue, the stump, as soon as the patient is in bed, should be se-

cured by a sheet or by a napkin, folded in the manner of a cravat. It is then also that some of the preparations of opium are particularly indicated.

D. After being placed in bed, some patients complain of acute pain. This pain, which in some is nothing more than the smarting of the wound, which subsides in a few hours, is increased in others so as to cause them to cry out, and to be under strong nervous excitement. We should then saturate the dressings with narcotic liquids; for example, decoction of marsh-mallows with laudanum, giving at the same time powerful doses of opium internally. When patients refer their pain, as is very common, to the limb they have lost, we must recur to the same treatment; but we must expect to see this symptom return for a long time, and even after the entire cure of the wound.

§ II.—*After the Operation.*

A. The accident, which still engages our attention the most after an operation, is hemorrhage, which is sometimes caused by our not having tied some of the more important arteries, or by some of the ligatures having become loose, or, more frequently than is thought, by a kind of irritative exudation going on from the surfaces of the wound. After the third or fourth day is passed, it is rare to have any other hemorrhage than this, unless the threads have too rapidly cut through the arteries by ulceration, or that there exists that remarkable condition of the system which Otto, Buel, Krimer, (Malle, *Thèse de Conc.*, 1836, p. 36,) Lobstein, (*Anat. Pathol.*, t. I., p. 211,) and so many others, have related examples of, and the peculiarity of which is, that the most trifling incision is followed by an incessant hemorrhage. Why hemorrhage should occur after the eighth or tenth day, it is difficult to say. Petit, Bromfield, Guthrie, and other practitioners, however, have seen it occur at the expiration of three weeks, a month, or even later. In one of my patients, after amputation of the thigh, it came on after the twenty-third day. The case is related of a patient operated upon by M. Roux, (*Dict. de Méd. et Chir. Prat.*, t. II., p. 213,) in which it did not appear until at the end of two months. The inflammation, which may seize upon the coats of the vessels in the deep-seated tissues of the stump, and the suppuration which surrounds them at the bottom of fistulous passages, can alone account for this species of perforation. Hey and Hennen maintain that consecutive hemorrhage frequently proceeds from the retracted skin strangulating circularly the subjacent tissues, and especially the venous canals; and that it is from this last mentioned class of vessels that the blood comes. This opinion, in my view, appears to be far from being well-founded. When the blood escapes from the veins, it is to be much more frequently imputed, as Ponteau remarks, to too unequal or powerful a compression made by the bandage upon the stump, than to the retraction of the skin; in that case, it is only necessary to remove the dressing and re-apply it more methodically, and the hemorrhage ceases immediately. An-

other species of hemorrhage, which appears to have been first indicated by M. Gouraud, is that which comes from the bones in consequence of their being in a state of necrosis; at every moment the blood is observed rising up between the living and dead tissue; compression, plugging, (tamponnement,) nothing stops it—nothing but the exsection of the altered part can subdue it. The swelling of the stump, attended with a considerable degree of inflammation, causes a hemorrhage, which may be suppressed in various ways: 1st, By saturating all the dressings with cold water, which is to be frequently renewed; 2d, By applying the tourniquet or garrote permanently upon the principal artery of the limb.

After having found all these means fail, whatever may be the cause of the hemorrhage, we may undress the wound and proceed in search of the bleeding vessel. As it is rare, in consequence of the changes which have been effected throughout the whole extent of the wound, after the first twenty-four hours are passed, that this last-mentioned means would succeed, we have then no other resource than to apply the agaric or sponge, as recommended by White and Brossard, upon the point from whence the blood issues, to *tamponer* (tamponner, *i. e.*, to plug) the wound, in whatever way it may be done, till the hemorrhage is arrested, to make use of the apparatus invented by Petit, or to have recourse to direct compression upon the gaping vessel, by means of small plugs of linen or lint, sprinkled with rosin, (colophane,) and held on by the fingers of assistants, who are to be relieved successively for several days; or we shall have to establish a sufficient degree of compression upon the track of the artery above the stump, by one of the means which I have elsewhere described, (see vol. I. and the present volume.) In a case where the arteries were ossified, (*Acad. des Sc.*, 1732, p. 536,) it was found necessary to make compression in this manner for the space of four days. In a patient, however, who, after amputation of the leg, was attacked with repeated hemorrhages after the thirteenth day, I succeeded, by means of the tourniquet of Petit, applied to the thigh for the space of three days.

A last resource, should it be practicable, consists in *laying bare the principal artery* and tying it above the wound. M. Ronx, Dupuytren, Delpech, Soumé and Ghidella have done this successfully. M. Arnal has given a recent instance of this kind, and I have in citing these cases also related others, (see this present volume.) J. L. Petit would have made trial of it, had not the debility of his noble patient deterred him, (*Malad. Chirurg.*, t. III., p. 164.) Pelletan (*Clin. Chir.*, t. II., p. 275) moreover formally recommends it, and I cannot perceive how Dupuytren, M. Ronx, Delpech or M. Guthrie can claim this suggestion for others. It is after all a means which may fail like the others. In a case related by M. Blandin, and in some others mentioned by M. Guthrie, this ligature applied as it is after the manner of Auel, did not prevent the flow of blood or ultimately save the patients from death. If the vessel which bleeds should be surrounded with soft parts we could also circumscribe it with a stroke of the bistoury at

the bottom of the wound, and by passing a ligature upon this groove immediately close the vessel, as was once practised with success by M. Sanson, (*Thèse de Conc.*, etc., 1836.) We should do wrong, however, to rank among hemorrhages that oozing (suintement) which, upon the first or second day, rarely fails to wet and soil the dressings and linens, and sometimes to go through the whole thickness of the cushions. Though it should be pure blood and not bloody serum, we have no reason to be at all under any apprehensions unless the patient has become thereby enfeebled. As a general rule, while the force of the pulse is sustained and the paleness of the face does not increase, cold ablutions and the tourniquet, if any thing at all be required, will be found quite sufficient.

B. Conicity of the Stump.—Since the labors of J. L. Petit and Louis, the cone-shaped form of the stump, an almost inevitable result of the mode of amputating formerly, has become a rare occurrence. By immediate reunion, when that does not fail, we almost constantly prevent it. It rarely occurs now except sometimes after the union by suppuration. Imputable entirely to the retraction of the muscles, it is in the power of the operator to prevent it, unless the cure should be complicated with some unexpected difficulty. The processes of Petit and Brunninghausen, which consist in bringing the skin only upon the stump, are deemed less efficacious than those of Louis, Alanson, Desault and Dupuytren, or than all those in fact which consist in cutting the muscles adherent to the bone much higher up (*beaucoup plus loin*) than the free muscles, (*fibres*,) but this is a question for future consideration. On this subject we must not forget that the muscles retract in some persons much more than in others, and much more so in proportion as their fibres are longer, or have been farther divided from their point of origin, or are more irritated, or slower in uniting and incorporating with the cicatrix; nor must we moreover confound their primitive with their secondary retraction. The shortening which immediately succeeds their section, is not in fact the only one that takes place; we often see the muscles, especially in patients possessing much strength and *embonpoint* at the time of the operation, but who become debilitated soon after; we often, I repeat, see the muscles draw themselves to a great distance within their sheaths, abandon the bones which they at first completely covered, thus rendering conical a stump which at the first dressing had the very largest kind of excavation. One of the means which contributes most to prevent this accident, is the care which the surgeon takes at each dressing to adjust the bone accurately to the centre of the stump. In this respect the flap operation has the objectionable inconvenience of favoring the slipping of the parts towards one of the angles of the wound. It is therefore then a matter of much importance to preserve a sufficiency of tissues in that part towards which the bone has a natural tendency to incline, either by means of the action of the muscles or the habitual direction of the stump.

After the operation we counteract the retraction of the muscles, by applying to the stump the moderately compressing bandage of the

ancients, as modified by Aitken, (*Essays on several important Subjects in Surgery*, 1771,) Alanson, Louis, and M. Richerand : arranging it in such manner, that instead of pushing the flesh backwards, like the capeline censured by Decourcelles, (*Man. des Operat.*, p. 372,) all the portions of the dressing on the contrary concur in bringing it forward ; we are also to dress the wound as lightly as possible, avoiding every thing which can irritate it, or cause it to suppurate or retard its union ; adjusting the stump in such manner that it may constantly repose between flexion and extension, and all its muscles remain in a state of relaxation. The projection of the bone, however, is to be apprehended notwithstanding all this, should the periosteum proceed to suppuration, and the pus detach the muscles of the stump, or if any serious affection should in the first eight days after the operation take such hold of the system as materially to interfere with the healing process going on in the wound.

C. Protrusion of the Bone, (sortie de l'os.)—The protrusion of the bone after amputations, whatever may be the cause, is always a grievous inconvenience. When it is slight and simple and without denudation we should not, M. Gouraud says, meddle with it. Nature will elaborate her work in ultimately removing the cicatrix by bringing the skin over the apex of the stump. If the patient is corpulent he will often find that this conicity will partially disappear, and present no obstacle to the employment of an artificial limb, (des moyens prothétiques.) When it exists to a greater degree, there is nothing but the natural exfoliation or exsection which can give relief.

I. Spontaneous Separation.—If the bone is not denuded, necrosis will not take place ; and we should be in an error to wait for its exfoliation, as advised by Lassus, (*Trad. des Fract. de Pott*, p. 181, 2e edit.) Paré, therefore, who made use of excision, was right, (Lib. XII., chap. 35.) Unless this were done, the osseous cone would, in the thigh especially, be in the way in applying an artificial leg, as in the cases mentioned by Veyret and Alanson, (*Opér. cit.*, p. 49, 50, 192, obs. 20,) and as I have also myself seen. This projection of the bone, moreover, is the cause of incurable ulcerations. The soldier mentioned by Salmon, (*De Art. Amp. rar. adm.*, § 9, sect. 2,) and who had both his arms amputated, is an example of this, to which I could myself add a multitude of others.

The articular extremities take a longer time to exfoliate than the body of the bones ; thus Smucker (*Bibl. Chir. du Nord*, p. 57) was obliged to exsect them in a patient whom he had amputated at the wrist. In a similar case, Reisenbach (*Trad. par Masuyer*, t. I., p. 218 ; *Bibl. du Nord*, p. 82) felt himself obliged to remove the lower extremity of the radius because it did not seem disposed to exfoliate. The heads of the bones of the metacarpus in a man who had had all the fingers disarticulated, having remained for ten months without exfoliating, I deemed it my duty, in order to secure the closure of the wound, to perform the operation of exsection.

II. *Exfoliation*, which was formerly considered unavoidable after an amputation, is at the present time deemed only an incidental result. As it is extremely tardy in being brought about, requiring thirty, forty, and sixty days, and even three and four months, to be completed, we should not, except in a very small number of cases leave this process to nature. The red hot iron, chemical caustics, as the nitrate of mercury for example, and which was frequently employed, down to the present times, and even as late as by Sabatier, do not in any degree accelerate it. It is much better to confine ourselves to gentle movements with the forceps, to be repeated at each dressing, and directed upon the pieces of dead bone (*escarre osseuse*) as soon as they become moveable. It is well to recollect, however, that this eschar sometimes disappears without any apparent exfoliation. An adult whose leg was amputated at the hospital of St. Antoine by Beauchêne, had a necrosis at the angle of the tibia, which we could feel with the probe, the wound closed over (*par dessus*) it, and at the expiration of a month a small abscess made its appearance; I laid it open, and a limpid, reddish pus flowed out, but there was no more necrosis, and the cavity soon cicatrised permanently. In another case where the whole stump had become involved in suppuration, I had for a long time before my eyes the extremities of the fibula and tibia, of a chalky and slightly yellowish color, rough and sonorous, in fact, completely necrosed; gradually they disappeared under the flesh, the cicatrization took place, and in four months the cure was complete. *Bones, then, that have been laid bare by pus, are not absolutely doomed to exfoliation.* I have now seen more than FIFTY cases, in which the bones of the cranium, nose, jaws, fingers, and toes, the fore-arm and leg, and the humerus and thigh, were bathed in pus and divested of their periosteum, and which, nevertheless, recovered without any perceptible exfoliation. [This is a valuable remark of the author, which is fully borne out by the experience of Dr. Mott and most practitioners who have been familiar with syphilitic and mercurio-syphilitic cases, more especially with the latter. We have noticed this fact in an especial manner at the *Seamen's Retreat Hospital*, in deplorable cases from those murderous, drenching salivations for syphilis, to which sailors are exposed in the hands of advertising empirics, as well as of empirical physicians. In such cases, where the energies of the system have not been too much prostrated, we shall find, by wholesome, generous diet, good air, and the mild alterative treatment with sarsaparilla, and iodine internally, and lotions of chlorine externally, with strict attention to drawing as forcibly together as possible the lips of the wound, by adhesive plaster, whenever dressed, and which should be as at long intervals as possible,—that the granulations, even on the frontal parts of the cranium where the teguments are so thin, and on the sharp edge of the tibia or ulna, where they are yet thinner, will, as our author has well described it, shoot out gradually over the white, dry, rough, denuded surface of the bone, and finally close the wound perfectly without the slightest perceptible exfoliation,

unless the constitution be greatly vitiated and prostrated, or the loss of substance in the soft parts be over the size of an inch in diameter. The word *necrosis*, however, as used by the author, to express this condition of the bone, expresses, as it seems to us, too much; for an actual *death* of the bone cannot, as we conceive, have taken place in these denudations. In fact, the natural, healthy, organic state of the parts, notwithstanding the loss of the periosteum, cannot have been sensibly changed, but the normal action only suspended, and not destroyed. No doubt, in former, as well as in modern times, this curious phenomenon of tenacity in the vital principle, had been noticed, but (though often observed by others) not, as we are aware, correctly described by any one before Prof. Velpeau. T.]

III.—The *exsection of the bones and of the stump*, which caused so warm a debate in the ancient academy of surgery, is described by Sabatier as a simple, easy, and but slightly painful operation; by others as a second amputation, often more dangerous than the first. When it is to be done, we should perform it so high up as not to be obliged to do it again, or endanger another conicity. We may conceive, moreover, that where the integuments and superficial muscles are far removed from the apex of the stump, it cannot fail to be otherwise than painful; while on the other hand, if the saw is to be used only at some lines above the dead parts or portion to be removed, it becomes an operation of the least importance.

After immediate (primitive) union especially, purulent inflammation, should it supervene, will sometimes attack the periosteum, which will then suppurate and become detached; the bone is then denuded, and soon mortifies, either throughout its whole substance, or only in a more or less considerable portion of it. At other times, the disease begins in the internal texture of the bone, which renders the accident so much the more serious. M. Moulinié has shown me a sequestrum of this kind, of more than six inches in length, and which comprised the entire circumference of the femur. One of those which I took from the humerus was over three inches. The first indication to be attended to in such cases is to dilate and divide, by means of the bistoury, everything which appears to interfere in the least degree with the free egress and discharge of the pus and other morbid matters; after which we should endeavor to limit the extension of the mischief, by applying expulsive compression from the upper part of the limb down to near the wound. We may then wait for the exfoliation. In other cases, after the evil has ceased to extend itself, we have recourse to exsection, or repeat the amputation a little higher up, as in operating for conicity. If all the tissues should be sound, perhaps there would be some advantage in imitating Wiegand, who, in such cases, makes two semilunar, lateral incisions with the convexity downwards, at a certain distance from the borders of the wound, and of greater or less length, according to the size and the greater or less degree of conicity in the amputated limb. These incisions which com-

prise the skin only, or the skin and superficial muscles, are made in such a manner as to avoid the vessels upon which a ligature might be rendered necessary. The teguments being thus detached, are then brought up and united in front of the bone by means of adhesive plasters or the suture.

C. *Hospital Gangrene*, frequently among the sequelæ of amputations, is one of the worst complications that can happen. As soon as it has seized upon the stump, or involved the integuments and muscles to a certain extent, and that the bone has become denuded, and topical applications and caustics have been tried in vain, amputation above the neighboring articulation, and if that be not possible, immediately above the limits of the disease, is one of the last resources we have to oppose to it. M. Gouraud obtained many unexpected cures from it, both in the army and at the hospital of Tours, where I myself was an eye-witness to them. Percy, MM. Willaume, and Desruelles, also adopted this practice, and I do not think we should hesitate in following it under the conditions which I have pointed out, that is to say, when, in spite of the cauterization with the nitric acid of mercury, and even with the red-hot iron, the gangrene continues to advance.

[GANGRENE. *Hospital Gangrene*.—The *vitiating condition of the atmosphere* in crowded hospitals, barracks, on shipboard in transports, camps, &c., depends upon the abstraction of oxygen or rather its displacement by carbonic acid and nitrogen, and the exhalation of various other deleterious gases, &c., from the skin and alvine and urinary excretions, &c. This will not only *predispose to*, but *generate* a new and malignant principle, or *morbific virus* which will manifest itself in fevers of a putrid and ataxic and adynamic type, in the degeneration of ulcers and wounds into hospital *pourriture* or gangrene, and in such degradation or diminution of all the vital forces as to diminish the chances of success in, or give a fatal termination to, diseases or operations of every kind. Thus Sir George Ballingall (*Remarks on Schools of Instruction for Military and Naval Surgeons*, also his *Treatise on Schools of Naval and Military Surgery*, 3d ed., Edinb., 1844) remarks that when military hospitals are over-crowded, too long occupied, or filled with a relay of *fresh cases immediately* after the removal of the old, results the most fatal are the consequence. In March, 1837, after an action, the surgical hospital at San Telmo afforded a striking example of this. "There were thus," says Mr. Allcock, (*London Lancet*, 1840-41,) "1041 patients in the hospital of the legion, calculated to accommodate, with due regard to health, 800; the chief press of the extra numbers fell upon the surgical hospital of San Telmo." The following gives the melancholy result:—Of 17 primary amputations there were only *two* recoveries; of 4 intermediary all died; of 3 secondary only one recovered, making a total of 24 cases of amputation and only three recoveries.

M. Ollivier, of Paris, has satisfactorily established by personal inoculation on himself (See his late work on *Traumatic Gangrene*) what was in our opinion long since familiarly known, that the

matter of hospital gangrene is *contagious* and will reproduce itself. *Sponge* has been, according to Sir Geo. Ballingall, (*Op. cit.*) ascertained to be a direct vehicle of this contagion, by the careless and culpable use of the same sponge to cleanse the ulcers among the sick of a regiment stationed at Feversham, England, as related by Deputy Inspector Marshall, (*Ib.*, and Cormack's *London & Edin. Monthly Jour.*, Dec., 1844, p. 1040.)

Some persons have on this account gone so far as to propose to discard sponge altogether as a detergent, from the difficulty of cleaning it, and this has been actually done in some English hospitals, (Cormack, *ib.*, p. 1041,) and *surgeon's lint* substituted.

We cannot agree with Sir G. Ballingall that *venesection* can ever scarcely be admissible in cases of hospital gangrene; unless it be in very rare instances in young robust subjects in whom the purulent infection has produced such violent perturbation in the cerebral and circulating functions as to have caused for the time being in the early stage a violent inflammatory febrile reaction, spasms, convulsions, local engorgement, &c. T.]

Amputation during non-limited Traumatic Gangrene.—The editors of the *Journal des Conn. Medico-Chirurg.*, (Paris, June, 1842, p. 257–8,) remarking upon a case of amputation which was performed near the head of the humerus on a young man by Mr. Toogood at Bridgewater, (Eng.,) during the height of a non-limited traumatic gangrene which had rapidly spread from a shot wound a short distance above the wrist, nearly as high up as the shoulder, observe that Mr. Toogood would not have deemed this remarkable if he had been aware of the fact that MM. Larrey, Gouraud, père, &c., had long been in the habit of this practice in the army, especially in wounds from fire-arms, where nature is powerless in arresting the progress of the evil and limiting the gangrene except by a violent general reaction.

Bleeding in Mortification.—There are cases, says Sir B. Brodie, (*Medical Times*, March 1, 1845,) where *bleeding* and purging will arrest the mortification and cure the patient as in robust habits—not so in persons whose constitutions are broken down by mercury, intemperance, &c., with small, weak, frequent pulse, anxious countenance, &c. Thus you find these two classes of patients where a neglected chancre has resulted in mortification of the penis. In the one where bleeding, not stimulation, is required, an artery perhaps while the physician is hesitating will spontaneously inflame, and after the discharge of a pint of blood an immediate amendment takes place by nature's unaided efforts. T.]

D. The inflammatory enlargement (*gonflement*) of the stump, sometimes shows itself in the form of simple erysipelas, at other times under the characters of an erysipelatous phlegmon. In the first case, if the skin only is affected, the adhesive plasters are frequently the cause of it, either because they have been drawn too tightly over the wound, or because they contain too great a proportion of matters of an irritating quality; we have then nothing more to do than to remove them, and to dress the inflamed surfaces

for a few days with emollient cataplasms. In the second case the accident is of a much graver character and merits the most serious attention. The phlegmasia rapidly extends itself; the muscles and skin are soon dissected by the pus; the sub-cutaneous tissues and the cellular prolongations (*trainées*) sometimes go on to mortify and slough off in large masses, (*se détacher par lambeaux*;) an ataxic or adynamic fever supervenes and the patient's life is placed in peril. Union by second intention is not often followed by such accidents; which is one of the strongest objections urged against the rigid partisans of union by the first intention.

As soon as these symptoms become manifested they must be vigorously combated; they are mitigated sometimes by uncovering the whole wound so as to dress it flat, and by applying leeches to the stump and then cataplasms; but when such means are unsuccessful, or when they are too late, I know of nothing more efficacious than deep and numerous incisions. In 1828 I had occasion to use the flap operation for an amputation of the leg. The whole thickness of the stump soon became the seat of an extensive phlegmasia; erysipelas and purulent collections already occupied the lower third of the thigh. The stupor and other adynamic symptoms went on with a frightful rapidity. I considered the patient lost beyond all hope. Beauchêne, who thought otherwise, made from eight to ten deep cuts upon different inflamed portions of the skin. From that time the symptoms began to subside and the patient recovered. It is against this erysipelas also with a greyish tint, and which so often terminates in gangrene in persons who have been amputated, that M. Larrey advantageously employs the actual cautery. The hot iron applied with a certain degree of force upon the inflamed surfaces, so as to imitate the branches of the fern or the nerves upon the laurel leaf for example, or other figures, certainly did wonders at the Hospital of the Guard where I have witnessed the most extraordinary results from it.

Suppose the disease should, after having given rise to numerous general phenomena, again become circumscribed to the part, there often results from it that denudation of the bone, and those fistulous burrowings with that conicity of the stump, which can only be cured by a second amputation. "Experience has taught me, says M. Gouraud, that wounded persons sustain amputation of the stump better than that of the limb, and that the success of the former is more probable than that of the latter. Of ten persons upon whom I performed it in 1814 and 1815, nine were cured." Instead of attacking the whole stump, the phlegmasia is limited sometimes to the cellular tissue surrounding the vessels, and especially the sub-cutaneous veins; there will then soon be found along the track of these canals, small purulent collections and abscesses, which are to be opened in good season, should not antiphlogistic means or compression have prevented their development.

E. Purulent Infection. Phlebitis.—The veins often become inflamed, either in themselves alone, or concurrently with the surrounding parts. Here as elsewhere *Phlebitis* is exceedingly dan-

gerous. The symptoms of adynamy, putridity and ataxy that are soon developed, are almost always followed by death; so that this becomes one of the most formidable of the accidents that can present themselves after amputations. The dangers which it involves, imputed even down to our own times to inflammation propagated up to the heart, depend as I have shown (see Vol. I.) upon a totally different cause. Purulent infection which is so often complicated with phlebitis, is another accident whose dangers are precisely similar. It is true that the researches of M. Monod and M. Reynaud, tend to prove, that the inflammation of the medullary tissue of the bones participates also in the production of those symptoms which are generally ascribed to phlebitis and infection from pus; but this is a question which requires new investigations, and I am of opinion that on this subject persons have had their minds warped by preconceived theories.

F. *Cystitis*.—We are often, says M. Gouraud, obliged to apply the catheter to persons who have been operated upon, and many observers have made the same remark. Whatever may be the primary cause of it, it is no less certain that cystitis is by no means an unfrequent consequence of amputations, and especially of amputation of the abdominal extremities; we must be prepared for this inflammation upon the least appearance of trouble in the urinary passages. It is useless to say that when this affection menaces blisters ought to be proscribed; but M. Blandin is evidently deceived in imputing it to this therapeutic agent, for it is observed where no preparation of cantharides has been made use of; as I saw in the case of a woman whose thigh was amputated by M. Roux, in 1826. For more ample details on the accidents we have just enumerated, and upon tetanus and every other disease that can be complicated with the results of amputation, I can refer only to treatises upon pathology properly so called, and to the article (see Vol. I.) upon *operations* in general.

ARTICLE VI.—ORGANIC CHANGES PRODUCED BY AMPUTATION.

As has been noticed by all surgeons, very remarkable changes after the removal of a limb, sometimes take place in the person who has been operated upon, changes which relate either to the stump itself or to the constitution in general.

§ I.—*In the Stump.*

The muscles, vessels, cellular tissue, aponeuroses, tendons and bones themselves, undergo at the place of their section, a transformation of such character, that all their parts are blended together in their union with the cicatrix, and consist at that place only of layers or fibrous cords, more or less dense and more or less distinct; the stump which had wasted at first, afterwards becomes the seat of a more active nutrition, increases in size, and finally at

the expiration of an indefinite period of time, attains in this respect the volume nearly of the root of the other limb.

§ II.—*In the rest of the System.*

Persons amputated upon, acquire a remarkable embonpoint, and an augmentation of energy in the organs of digestion, circulation and reproduction; the vital fluids compelled to circulate within narrower limits, increase the activity of all the functions, in the same way as the intensity of a light becomes more and more vivid in proportion as we concentrate its rays. The tendency is to the formation of the sanguine temperament. The salutary efforts of nature to remedy this too great plethora of the system, are manifested according to the age and sex in epistaxies, hemorrhoids, more abundant menstruations, a greater frequency of stools, and more copious perspiration and secretions. Garengéot therefore advises in order to prevent this plethora and crowding of the blood, that patients who have had a limb amputated, should from time to time be bled, that they should reduce their nourishment one quarter part during the first year, and abstain from violent exercises. A soldier in the army of the Eastern Pyrenees had his two thighs amputated and recovered perfectly. The activity of all the viscera, particularly the stomach, increased to a singular degree. In a short time this man acquired a corpulency the end of which it was impossible to foresee. The stools in fact were nearer together without however any perturbation of the belly. But the immobility to which this double mutilation subjected him made his plethora itself a disease. A species of carriage was procured. This passive movement did more harm than good, because it favored digestion more than transpiration and the other excretions. This unfortunate person finally sank under the burden of sanguineous plethora. "I have seen hundreds of such cases, says M. Gouraud, and they appear to me every way worthy the attention of physicians." I have myself seen a young soldier in whom it became necessary to amputate in succession a leg and both arms, also an employé in a bureau who had had his thigh taken off, both of whom by the plethora which ensued, fully confirm the observations of this practitioner.

ARTICLE VII.—PROGNOSIS OF AMPUTATIONS.

Amputations have always been considered very dangerous, and they are so in reality. Nor can anything be more uncertain than the consequences which may result from them. Welschius (Bonet, *Corps de Méd.*, t. IV., p. 312) says, that out of five persons amputated whom he saw at the Hôtel Dieu, four terminated fatally. Out of twenty-nine operated upon by M. Baudens (*Gaz. Méd. de Paris*, 1838, p. 346, 347,) or his assistants at the expedition to Constantina, twenty-four died, while out of twenty others amputated by M. Pointis (*Ibid.*, p. 448) at Bougie, during the space of four years, not one perished! M. Warren has lost eight out of forty at the

Hospital at Boston, while M. Chelius, (*Arch. Gén. de Méd.*, 2e série, t. IX., p. 229,) at Heidelberg, has saved twenty-seven out of twenty-nine. The English surgeons, who maintain that a greater proportion of persons amputated die in France than among them, attribute it to our mode of dressing; but in examining the fact in itself, M. B. Philipps has recently read a paper (1838) at the Med.-Chirurgical Society of London, by which it appears that the mortality in persons amputated is at least as great in England as in France. At La Charité, I have in the course of one year lost but two out of twenty-six. In the preceding year I had lost six out of twenty-one, and in following year I lost four out of nineteen. A young surgeon of Philadelphia maintained that in his country persons do not die from amputations as they do with us. Upon returning to America, he ascertained that six died out of twenty-four. A pupil of the Hospital of Lyons considered himself fortunate in saving twelve out of seventeen, and M. Laborie (*Bull. de Thérapeut.*, t. XV., p. 165) eulogizes a kind of dressing by which only four are lost out of every eleven.

An opinion has gained ground among physicians, that in the hospitals of Paris we lose one in every two or three patients; but this is not generally true. As to myself, I have lost but one in every five or six. It is, besides, impossible in this loose way to form a correct opinion of the mortality of amputations. Success or failure in these cases depends more than anything else, upon the nature of the lesion which requires the operation, the accuracy of the diagnosis as to the condition of the viscera, the importance of the limb to be amputated, the circumstances and the precautions connected with the patient, and the hygienic means and consecutive treatment employed; therefore, when patients die, is it *from the amputation*, or *in spite of the amputation*? Other things, moreover, being equal, amputations are more dangerous in hospitals than in private practice, under an extreme than in a mild temperature, during epidemics than in an ordinary healthy condition of the atmosphere, in men than in women, in old men more than in adults, in adults more than in children, in the lower rather than in the upper extremities, and near the trunk more than at a distance from it. I ought also to remark that amputation of the fingers has to me appeared more dangerous than that of the toes, and that the former, in itself, is not less hazardous to life than amputation of the arm.

SECOND PART.

AMPUTATIONS IN PARTICULAR.

CHAPTER I.

THE UPPER EXTREMITIES, (Membres Thoraciques.)

The upper extremities, exposed by their uses and their relations with external agents to every kind of injury, frequently require amputation. The principle in regard to them, is to take away from them as little as possible. The small portion which is preserved rarely fails to be still of some service. We thus amputate separately the fingers, the several bones of the metacarpus, the hand alone, the wrist, the fore-arm in its continuity, and at its articulation, the arm at different points of its length, or at its union with the shoulder, or the shoulder itself.

ARTICLE I.—PARTIAL AMPUTATION OF THE FINGERS.

The amputation of the fingers, though but slightly mentioned by the ancients, must have been had recourse to by them in a great number of cases, and at the present day is very frequently performed, and in a great variety of modes, whether we limit ourselves to the removal of one of the phalanges only, or take away the whole, whether we amputate in the continuity of the bones, of which they are made up, or prefer doing it at the articulations.

§ I.—*Anatomy.*

The fingers, composed of three pieces of bone, articulated in the two anterior phalanges in the manner of a hinge, (*en ginglyme*,) and at the metacarpal phalanx by *enarthrosis*, (*enarthroses*,) are, moreover, composed of tendons, fibrous grooves, (*coulisses*,) synovial sheaths, arteries, and nerves of considerable size, and also of a cutaneous covering, distinguished on its anterior surface by remarkable characters. It is upon their palmar face that are found the two flexor tendons and the fibro-synovial groove, in which they glide. One of these tendons is attached at one extremity to the articular projection (*renflement*) of the third phalanx, (*phalange unguéale*,) and at the other to the metacarpal phalanx by means of a simple fibrous bridle. The two layers of the other flexor, on the contrary, are attached to the sides of the middle phalanx. As

all the flexor tendons are gathered together in the hollow of the hand before they reach the wrist and the fore-arm, nothing can be more dangerous after amputation of the fingers, than inflammation of their sheaths. From their synovial sheath, terminating in a cul-de-sac only, on the anterior surface of the metacarpo-phalangeal articulations of the two or three median fingers, operations performed on the thumb or little finger are thereby rendered yet more dangerous. From the cellular tissue being accumulated in front in form of a cushion, this part is generally selected from whence to obtain soft parts to cover the stump after an operation. From their dorsal surface being more convex, it would be rendered more difficult to cut out in that part a flap of sufficient width and thickness. From the two arteries that run along their sides, (*les côtoient*,) lying so close to the bones, compression upon them may, without any difficulty, be substituted for the ligature. The two phalangeal articulations have this about them remarkable, that being supported on their sides by two very strong ligaments, and in front and behind by tendons of considerable strength, they cannot be divided but by means of certain precautions. The pulley which their head terminates in, and the small cavities separated by a crest which are found upon the posterior extremities of these phalanges, are also important, to be noted in enabling us to guide the action of the bistoury with security.

The skin in these parts possesses peculiarities which are of so much the more importance, that these are not ordinarily effaced by its morbid condition. In the midst of a considerable number of folds and wrinkles which are found upon its dorsal surface, there are three which must be particularly recollected. One which is perfectly transverse, corresponds almost always with the line (*interligne*) of the articulation; the second, convex behind, lies over the union of the head of the posterior phalanx with its body; while the third, convex forwards, has the same relation to the anterior phalanx. The palmar surface of the articulation of the third (*phalangétienne*) phalanx, is directly underneath, or at farthest, at the distance of a line in advance of the transverse groove which is alone found upon the skin at this part. The same may be said of the middle articulation, in respect to the deepest and most clearly defined (*la plus tranchée*) line in the integuments which surround it. The metacarpo-phalangeal articulation, surrounded like the preceding, by two lateral ligaments, and flexor and extensor tendons, has, moreover, in front of it, or upon its sides, the termination of the lumbricales and inter-ossei muscles, and the trunk of the collateral arteries which bifurcates only a short distance further in advance. As it is upon the head of the metacarpus that the phalanx turns, this latter, during flexion, is almost entirely concealed under the former, which alone forms the projection which is seen in the knuckles. These articulations are not upon the same line. The transverse groove on the palm of the hand which corresponds to the articulation of the fore and little finger, is situated many lines farther back than that of the two intermediate fingers.

The best mode of striking upon them is to look for them at ten to twelve lines farther back (au delà) than each inter-digital commissure ; by which arrangement, also, the cushion of their palmar (antérieure) surface serves for an excellent flap to cover completely the head of each metacarpal bone when we remove all the fingers.

§ II.—*Amputation.*

In former times, the fingers were always amputated in the continuity of their phalanges. In the time of Fabricius of Hilden, they were removed by a cutting forceps, gouge, chizel, or some other similar instrument, operated upon by strokes of a mallet. At a later period, the saw was substituted for these, which, in addition to their clumsiness, had, says Fabricius of Hilden, (Bonet, *Corps de Méd.*, p. 516,) the inconvenience of splitting the bones and giving rise usually to very serious consequences. Verduc, Petit, Garangeot, Sharp, and most modern surgeons, opposed this manner of proceeding ; so that, for a long time past, amputation of the fingers in the continuity was abandoned. The operation, it is averred, is more difficult, and that the portion of the phalanx which is left can be of no use. Upon this subject, it would seem to me, they have gone too far, and that it is better, as Le Dran (*Operat.*, t. I., p. 308) and MM. Guthrie and S. Cooper think, to saw through the phalanx where it is practicable, than to extirpate it entire : in the fingers there is no part which has not its uses and importance. M. Graefe occasionally has no hesitation in still employing the chizel and hammer, (Rust's *Handb. der Chir.*, t. I., p. 620.) A young military surgeon, M. Moreau (*Gaz. Méd. de Paris*, 1836, p. 93) has specially pointed out the advantages of amputation in the continuity of the phalanges, and I have often had occasion to confirm in practice the opinion which I first expressed upon this subject.

A. Amputation in the Continuity.—We will suppose the disease to be confined to one of the two last articulations. It is clear that we cannot remove it entirely, without dividing the posterior phalanx at a certain distance from the diseased articulation, and that the remainder of the bone cannot fail to prove serviceable to the patient. We may moreover perform this operation, either by the circular or flap method.

I. Circular Method.—In the first mode, the integuments are to be divided as near as possible to the part affected ; we then push them backwards, in order to divide the tendons and effect the section of the bones by means of a small saw, or, what is better, by a good cutting forceps, (tenaille incisive,) at three or four lines farther back than the point where we commenced the incision.

II. The Flap Method.—In the second process, we may confine ourselves to a single flap, which it is better to cut in front, or, doing as Heliodorus formerly did, (*Nicet, de Lus quæ Digit. accidunt*, p. 159,) we may, should the soft parts not make it objectionable, make two flaps, giving then a little less length to each. Reunion, also, by the first intention, should be attempted in both cases.

B. *Amputation in the Contiguity*.—I. *Circular Method*.—The skin is divided circularly at three lines in front of the articulation. The assistant pulls it back, in order that we may be enabled to divide the extensor tendon higher up, and enter between the phalanges on their dorsal surface, after having divided the lateral ligaments. It is not until the bistoury comes out on the palmar surface, that the section of the flexor tendons is accomplished.

This process which was followed a long time ago, described by Garengéot, and recommended by Sharp, Bertrandi, (*Opérat. de Chir.*, p. 504,) Leblanc, (*Opérat.*, t. I., p. 308,) and Lassus, (*Méd. Opér.*, p. 545,) and which has been generally adopted in England, is quite as good as any other, and allows of a ready facility of union by the first intention.

II. *Flap Method*.—A *Process of Garengéot*,—*Flaps of the same length, one dorsal, the other palmar*. Garengéot (*Opér. de Chir.*, t. III., p. 436) recommends that we should adopt for amputation of the fingers the method of Ravaton, or what is better that of Heli-odorus; that is to say, that we should make two lateral incisions united in front by a circular incision; that we should dissect off the two flaps thus made and raise them up to a level with the articulation before dividing that, and that we should then unite them by first intention.

b. *Process of Ledran*, (*Opérat.*, p. 576,)—*Two flaps, one to the right, the other to the left*.—In the place of making two flaps, one in front and the other behind, Le Dran makes them on the side, and gives them a semi-lunar form; this is the process lately described anew by M. Maingault, and very properly condemned by M. Blandin.

c. *Process of Laroche* (*Encyclop. Méth.*, part *Chir.*, t. I., p. 108,) or of Loder, (*Rust's Handbuch der Chir.*, t. I., p. 635,) attributed to M. Lisfranc—*A Palmar Flap only*.—The skin is divided at about the distance of a line in front of the transverse fold on the dorsum of the finger in order to be enabled to penetrate the articulation at the first stroke. The lateral ligaments are also immediately divided by inclining the bistoury first to one side then to the other. The articulation being completely separated, we have nothing more to do than to cut out a palmar flap of sufficient length to close the wound perfectly. The operation by this mode is performed in an instant. The cicatrix being turned towards the dorsal surface of the finger is, it is said, more favorably situated than when in front; a very questionable advantage certainly, and one that is more than counterbalanced by the risk of having the phalanx denuded posteriorly. Besides the disease does not by any means always permit us to obtain a flap of sufficient length.

d. *Process of M. Lisfranc*.—The diseased finger is placed in supination; the bistoury is inserted transversely and flatwise in front of the palmar line, between the soft parts and the phalanx, the palmar (antérieure) surface of which is grazed in order to obtain a flap similar to the preceding, and which is then raised up; the joint is then divided from before backwards, without leaving any posterior flap. This process is not as good as the preceding one.

e. Process described by Laroche, (Encyclop. Méth. part. Chir., t. I., p. 108,) and adopted by M. Walther, (Rust's Handb., t. I., p. 625.) A dorsal flap only. When the disease does not admit of our forming a flap in front, (*i. e.*, a palmar flap,) we may divide the skin at one line in advance of the palmar furrow, and thus arriving at the fibrous groove, tendons, articulation and lateral ligaments, finish by forming a flap from the dorsal surface of the finger which has been amputated. The cicatrix being less exposed to view and to the action of external agents, offers, it is seen, some advantage, as Laroche says, (*Encyclop.*, p. 108,) to people of condition; but in persons who work in the fields, it exposes to painful contact with hard bodies, which an infinity of laborers are obliged to seize with the hand. It is therefore from necessity and not from preference when we are obliged to operate in this way.

f. The Usual Process.—Two Flaps. MM. Richerand, Gouraud, (*Handb. der Chir.*, t. I., p. 625,) &c., recommend making two semilunar flaps, one dorsal and the other palmar, and each from three to four lines in length. This process, modified in the following manner, appears to me to be of a more general application, and fully as secure and as prompt in its execution as any other; I proceed to describe it more particularly:—

g. Process of M. Rust, (Princip. Opér., etc., p. 84.) The Palmar Flap longer than the other. The operator seizes the diseased finger and gently flexes it as he draws it towards him, while an assistant supports the upper part of it, flexes the other fingers or separates them from the first, and fixes the entire hand in pronation. He then with a narrow bistoury, held in the first position, passes it from one side to the other through the entire track of the anterior fold of the skin, and cuts out a small semilunar flap, with its convexity towards the nail; the divided teguments are drawn back by an assistant; the bistoury ascending with them, traverses the joint as it divides the extensor tendon, and cutting the lateral ligaments to the right and left, passes between the articulating surfaces, and arrives at the anterior ligament. The surgeon then directs the cutting edge of his instrument forwards to make it glide upon the palmar surface of the phalanx, which he has just disarticulated, and to form a flap of from four to six or eight lines in length.

h. The anterior (i. e., the palmar) flap is the one to be principally depended upon, though the other is not without its use. That it may not be too short, and in order that we may at the same time give it the necessary length, I think with Delpech, that it is more prudent before terminating its section, to take the measure of it, so to speak, by raising it upon the articular surface (*facette*) which it is destined to cover. All these processes, however, enable us to obtain our object. The trials I have made of them have convinced me that we may to a certain extent adopt any of them indifferently; that the preference to be given in such cases, depends much more upon the pathological condition of the parts or the fancy of the surgeon, than upon the absolute value of the operative process.

At all events, the amputation of the phalanges is an easy operation. It is certain, however, when we can control the choice, that the mode I have just described, and that which comes under the circular method, are to be preferred. The others will not be necessary, except where we are obliged from the condition of the soft parts to cut the flap entirely from one only of the two phalangeal surfaces.

C. *Dressing and subsequent Treatment, (suites.)* The operation having been completed by one process or another, it rarely becomes necessary either to tie or twist the arteries. The blood, after the amputation of the phalanges stops of itself, or by means of gentle pressure. If, however, we should prefer using the ligature, each thread should be afterwards arranged at the corresponding angle of the wound. The two flaps, carefully brought together, are kept in contact by one or two strips of adhesive plaster, which embrace the stump in the form of a noose, and are carried back to the wrist upon its dorsal and palmar surfaces. A perforated linen besmeared with cerate, a little dry lint, a soft compress and a narrow bandage to adjust the whole, complete the dressing. In respect to regimen, a light diet for two or three days, and afterwards nourishment somewhat diminished in quantity and less succulent than usual, are the only restrictions to which the patient is to be subjected.

D. *Accidents.* Provided the patient keeps his hand in a sling, (écharpe) it is not necessary to confine him to his bed, unless accidents should supervene. The best method, however, in these cases, of preventing any complications, or remedying them when they do occur, is to establish a uniform, (exacte) and regular compression, from the fore-arm to the wound, including therein the hand, which is to be well protected (garnie) on its two surfaces.

If unfortunately, purulent inflammation should seize the stump, we must hasten to remove the bandages, and to substitute emollient cataplasms in their place, and endeavour to check the disease by leeches, mercurial unctions, or even deep incisions. This inflammation, from its propagation along the synovial membranes (toiles) becomes one of extreme danger, and together with phlebitis renders amputation of the phalanges as formidable almost as that of the arm, especially amputation of the thumb, forefinger, and little finger. As we are not obliged in the last (unguéale) [*i. e.*, the third] phalanx, to open so completely into the tendinous groove, the operation here is attended with much less danger than in the others. I will add that I have in three cases of amputation of the phalanges, obtained complete and immediate union, without any suppuration.

§ II.—*Amputation of a whole Finger, (amputation de chaque doigt en totalité.)*

Some surgeons, and among others, Lassus, (*Méd. Opér.*, p. 543,) have laid it down as a precept, that when the middle phalanx is diseased, the first should also be removed at the same time; since,

say they, this last, when preserved alone, remains immovable, and becomes much more embarrassing than useful. To remedy this inconvenience, which he explains by saying that, after the removal of the second phalanx, the flexor tendons are deprived of every kind of point d'appui, and are incapable of acting on the first phalanx, M. Lisfranc (Coster, *Manuel de Méd. Opér.*, 1823) has conceived the singular idea of making at first one or two incisions in front of the metacarpal phalanx, to traverse in this manner the whole thickness of the soft parts, in order to promote inflammation of the tendons and their previous adhesion to the surrounding tissues; but this would be making two operations instead of one, and as I have said elsewhere, (*Anatom. des Régions*, t. I., 1825, first edition,) and as has been well remarked by M. Scoutetten since, (*Arch. Gén. de Méd.*, t. XIII., p. 54,) the object which M. Lisfranc has in view is naturally accomplished by the fibrous bridle which attaches one of the flexor tendons to the first phalanx of the fingers. Even though this anatomical arrangement should not exist, we should not have to fear the immobility mentioned by Lassus. After the cure, the tendons invariably become fixed to the neighborhood of the cicatrix, if they do not to the bone itself, so that nothing hinders them from flexing or extending the root of the amputated finger. On the other hand, observation proves that these fears are purely theoretical. All the patients I have seen, who have had the two last phalanges removed, have used the first perfectly well, and would have been lothe to have had it sacrificed. It is not proper, therefore, to amputate the whole of the first phalanx, unless the disease has extended so far as to make it absolutely necessary. [A great deal of new and valuable anatomical surgery, and the settlement of many curious, nice, and exceedingly important points of controversy, have come before the public on this difficult subject of the *division of the flexor tendons of the fingers*, (in tenotomy especially,) since the author penned the text in this part of his work. By referring to the interesting discussion which took place recently in the Paris Academy, and which we have embodied in our first volume, it will be seen that Prof. Velpeau himself, as well as others, have contributed many new and interesting facts upon this subject. T.]

Considering that after the operation the two collateral fingers are found widely separated by the head of the intervening metacarpal bone, Dupuytren preferred amputation of this last bone in its continuity to simple disarticulation of the finger. If the patient incurred no more risk by one mode than the other, or if the head of the metacarpal bone did not ultimately become narrower, (s'aplatir,) so as to permit a nearer approach of the two neighboring fingers, we might adopt this process which M. Champion and many other modern practitioners have sanctioned, and which the English, M. Larrey says, (*Clin. Chir.*, t. III., p. 609,) employ to prevent inflammation in the fibrous structure of the hand; but this is entirely the reverse, and the surgeon ought not to go beyond the metacarpophalangeal articulation, unless he is compelled to do so.

A. *Circular Method*.—The disarticulation of the fingers is performed only by the flap or oval method. The circular, carelessly described and adopted by some authors, by Leblanc (*Précis des Opérat.*, etc., t. I., p. 328,) among others, and recommended also by M. Cornuau, (*Thèse* No. 71, Paris, 1830,) is attended only with inconveniences, and ought to be rejected.

B. *Flap Method*.—I. *Process of Sharp*.—After having made a circular incision upon the root of the finger in front of the commissure, Sharp (*Opérat. de Chir.*, p. 390) proposes that we should make another upon each side in order to form a dorsal, and afterwards a palmar flap, before proceeding to the articulation. This is a mode which is inherently defective, and which no one ought to follow, notwithstanding the modification which Rust (*Handb. der Chir.*, t. I., p. 621) has given to it.

II. *Process of Garengcoot*, (*Opérat.*, t. III., p. 431.)—The root of the finger, at first isolated down to the articulation by two lateral or parallel incisions, is afterwards laid bare upon its dorsal surface by a semilunar or transverse incision. There is then nothing left but to divide the extensor tendon and the sides of the capsule, in order to separate the joint and remove the finger, while terminating by the section of the flexor tendons and the skin which covers them. This is the process described by Bertrandi, (*Traité des Opér.*, p. 504,) Leblanc, &c. The one that many moderns have substituted for it differs only in this, that the extremities of the two lateral divisions are made to join upon the dorsal and palmar surfaces of the articulation, in place of being united by a transverse incision.

III. *Process of J. L. Petit*—(*Malad. Chir.*, t. III., p. 208.) The root of the finger, circumscribed by two semicircular incisions which include its commissures and are prolonged obliquely in converging to become united behind on the dorsum and in front of the hand, is first laid bare down to the articulation, which is opened and then separated from one side to the other or from before backwards.

IV. *By Puncture*. In place of dividing from the skin to the bones, as in the preceding mode, we may, as Rossi (*Méd. Opérat.*, t. II., p. 235) proposes, plunge in the bistoury from the dorsal to the palmar surface, in order to cut out successively the two flaps from within outwards and from behind forwards, that is, from their base to their apex; but this is a process which has no advantage over the others, and which makes a less regular wound than that of Petit, of which in fact it is only a repetition reversed. M. Plantade (*Thèse de Montpellier*, 1805) proposes, after having formed in this manner the first flap, that we should divide the joint and finish as in the following method, which is somewhat less objectionable.

V. *Process of Ledran*, (*Opérat. de Chir.*, p. 577,) or of M. Gouraud, (*Princip. Opér.*, p. 83,) improved by M. Walther, (Rust's *Handbuch*, t. I., p. 622,) and attributed to M. Lisfranc, (Malgaigne, *Man.*, etc., p. 304.) The assistants seize the hand turned in pro-

nation, and also the sound fingers, holding them apart from the median line while they keep them extended. The operator seizes the diseased finger with his left hand and exerts some movements upon it in order to be the better enabled to identify the articulation. Holding the bistoury in his right hand in the first position he directs its heel upon the dorsum of the articulation, or commences even at four or five lines beyond that, and dividing the skin reaches the middle of the commissure upon one side; depressing the wrist he prolongs the incision in the same direction nearly up to the groove which transversely crosses the palm of the hand in front of the joint. The cutting edge of the instrument is brought back upon the convexity of this semicircular wound, to divide from before backwards the remainder of the soft parts down to the articulation, which is laid open upon the side by turning the edge of the instrument transversely into it as soon as it reaches behind the head of the phalanx; while we are dividing the joint and the aid is drawing the skin gently back towards the wrist to the right or to the left, we reverse the finger as though we were in the act of luxating it. Dividing the extensor and flexor tendons at the moment the assistant is drawing upon the teguments in an opposite direction in order to protect them from the action of the bistoury, the surgeon finishes the operation with a second flap, similar to the first, but cut in the direction from without inwards, and from the metacarpus to the interdigital commissure on the opposite side.

VI. To give greater length to the *flaps*, Garengeot and some others recommend to commence the first and terminate the second flap at some lines in front (*au-devant*) of the commissures. Others propose that their apex should be cut off square, and not made pointed as they generally are. It has appeared to me that by approximating the root of the fingers with some degree of care, we may very easily bring the two sides of the wound in contact, without having recourse to the above precautions, which however have no other inconvenience than that of exposing the skin to become turned back upon itself and to render the operation somewhat more difficult.

When the first incision is made, it is well, in order to run no risk of going beyond the head of the bone and to avoid all kind of groping in the dark, to search with the fore-finger for the internal tubercle of the phalanx which is to be removed; which is moreover an easy matter, as it is the first projection we meet with behind.

I would recommend that the first incision should be prolonged nearly a half an inch beyond the articulation, because we can then divide with much greater ease all the fibrous tissues which surround it without interfering with the other lip of the wound, and because we shall be more easily enabled by this means to cut out the other flap in a regular manner.

When we have adopted the precaution of grazing the sides of the phalanx and of not passing beyond the head of the metacarpal bone, the trunk of the collateral arteries will generally be found to

have escaped; there are but two vessels which bleed, and which can be tied or twisted if they do not stop of themselves.

The process of Ledran is the most rapid of all, and has no other disadvantage than that of not always allowing us to give the same regularity nor exactly the same form to the last flap as to the first; in this respect the method of Petit is preferable to it, and does not merit the censures which some persons have bestowed upon it.

C. *The Oval Method*.—The hand of the patient, the assistants and the operator are arranged as in the preceding process: we commence also in the same manner.

I. *Process of M. Scoutetten*.—The surgeon seizes the affected finger with his left hand, and gently flexes it while holding it slightly apart from the others, and then commences the incision upon the dorsal surface behind the articulation, with the heel of the bistoury which he gently brings forward to the border of the commissure, and comes round with it upon the palmar surface of the finger, by cutting exactly upon the semicircular line which separates it from the hand, properly so called; arrived at the opposite border, he re-conducts (reporte) the bistoury to the anterior or phalangeal extremity of the wound, and brings it back obliquely to the metacarpus to unite the two extremities of the incision. Without leaving the part to be severed he widens the lips of the wound as much as possible, divides the extensor tendon, then the lateral ligaments, increases the flexion of the finger in drawing upon it as if in order to dislocate it, reaches its palmar surface by passing the bistoury through the articulation, and finishes by dividing the flexor tendons as well as the soft parts which connect the phalanx to the cellular cushion of the hand.

II. In the place of following the palmar groove of the finger, on arriving at its commissure, it is more convenient to make the second incision immediately in the same manner as the first. We then disarticulate, and proceed for the rest of the operation in the mode just described. We have thus circumscribed a V incision, and the wound does not present the form of an oval until after the operation is finished.

III. In the ovalar method we rarely divide the common trunk of the collateral arteries. Provided we have not given too much width to the point of the flap which is to be removed with the finger, [*i. e.*, the point or angle on the dorsal surface of the hand immediately behind the articulation where the two incisions meet, or where they commence, if we adopt the modification of M. Velpeau above. T.] the two lips of the wound may be brought together with ease and reunion effected with more facility and certainty by this than by any other method. It is therefore the process which ought to be generally adopted; and it possesses so much the greater advantage that it does not require the skin to be sound to so great an extent as in the others. The wound which results from it, leaving the palmar cushion untouched, offers in fact a surface one half less in extent than by the flap method, and its regularity always renders coaptation easy; but to perform it well, it is necessary to be

intimately conversant with the anatomy of the parts, and to have had much practice with the operation, and its repetition on the dead body.

§ III. *Amputation of the four last Fingers at one Operation, (ensemble.)*

Some ancient authors, with various works on military surgery, and many theses written at the commencement of the present century, show that the amputation of all the fingers at one operation had been already practised. In a case where the fingers of both hands had been mutilated by the bat of a cotton dresser, I had an opportunity of putting in practice at the same time all the known methods, and of obtaining flaps from all the sides of the fingers, either to give length to the stumps, or take advantage of the facilities offered by the soft parts intended for covering the bones. In 1804, I was so fortunate as to have it in my power to prevent amputation at the wrist in a young lady who had all the fingers burnt except the thumb, which remained sound. The cure was protracted, but the results were of immense importance to the patient, (Champion, *Private Communication*.) The cases, however, which demand this kind of operation may be readily conceived without the necessity of pointing them out in detail. The crushing of the parts, (un écrasement,) a projectile from a cannon, congelation, or any thing which would at once disorganize the four appendages of the hand are of this nature. Nevertheless as the cases are rare, where all the fingers are destroyed up to their metacarpal articulation, and no farther than that point, there must be but few occasions where the operation is called for.

A. The hand and the fore-arm being held in the same manner as for amputating a single finger, the operator having seized hold of the fingers which he is about to remove by placing his left thumb transversely upon their dorsal surface, and his left fingers upon their palmar surface, gently flexes them and directs the assistant to stretch the skin by drawing it backwards; he then with a straight bistoury makes a transverse incision slightly convex in front, and from six to eight lines below the extremities of the metacarpal bones, taking care to commence at the fore-finger if he is operating on the left hand, and at the little finger if on the right hand. This first incision exposes the extensor tendons in front of the articulations. As soon as the integuments are properly drawn back the surgeon opens into the articulations, and divides their anterior ligament. Nothing more remains for him to do than to pass in front of the head of all the disarticulated phalanges a narrow knife, with which he cuts from behind forward a large semi-elliptical flap, whose limits are naturally marked out by the groove which connects the palmar surface of the fingers with that of the hand. The same knife might serve also for the dorsal incision; but as it is necessary to pass successively over projections and depressions, the bistoury is much more convenient.

B. In order to prevent the [subsequent] protrusion of the flexor tendons we must divide them upon a line with the articulation before finishing the flap. For this purpose it would be better, perhaps, after the dorsal incision has been completed, to cut out the palmar flap as M. Caillard (*Thèse* No. 307, Paris, 1833) proposes, before proceeding to the disarticulation. In order to make the circular incision, M. Cornuau (*Thèse* No. 71, Paris, 1830) first incises the entire palmar groove, then proceeds to the dorsal incision and finishes with the disarticulation. This process is as good as any other, no doubt; but in an amputation of this kind the surgeon ought to hold himself in reserve to regulate his conduct by the condition of the parts rather than by what he learns in books.

C. There are eight arteries divided by this operation. As they are bent at an angle upon themselves, (*les coude*,) in raising the tissues to close the wound, it is not generally necessary to apply the ligature. The palmar flap, usually the only one, and always the longest, has no need of sutures to unite it to the dorsal. Strips of adhesive plaster suffice to keep it firmly attached to the head of the metacarpal bones. Over these we apply a perforated linen, spread with cerate. The whole is then covered with a thin layer of lint, then a soft compress, and some long ones which embrace the stump from before backwards, or obliquely, and in the same direction as the adhesive straps. After having properly padded (*matelassé*) the palm of the hand, nothing more remains than to support all these pieces by means of a bandage, the turns of which, brought more or less into proximity with each other and drawn tolerably tight, should be extended above the wrist and passed once or twice between the root of the thumb, the remainder of the hand and the free extremity of the stump.

D. The same or nearly the same kind of bandage also will answer after the extirpation of a single finger. Nevertheless we proceed somewhat differently, according as we have preserved flaps or confined ourselves to simple oblique incisions. In the first case, in fact, there is required a narrow strip of adhesive plaster to fasten the two portions of preserved tegument upon the head of the metacarpal bone; while in the other case it is sufficient to pass one crosswise and to approximate the roots of the two collateral fingers, as much as possible by drawing gently upon the bandage as it passes round the borders of the hand. It is the same when we have adopted the oval method.

E. There is no need of remarking that when we wish to amputate two or three adjoining fingers only instead of four, the operation should be conducted upon the same principles, that is, in such manner as to have but one flap for the whole wound instead of disarticulating them by as many separate operations.

§ IV.—*Accidents.*

However easy or trivial the disarticulation of the fingers may seem, it is nevertheless frequently followed by very serious accidents. A

man and a woman, in the year 1825 and 1826, died from this cause in the hospital of Perfectionnement ; and a patient upon whom I operated at La Pitié, in 1831, perished in the same way. Among those upon whom I have operated at La Charité, two have died, and it would be no difficult matter to find similar examples elsewhere. It is sufficient to remark that the operation should not be decided upon but with caution, and where absolutely required. Its dangers arise from the extreme facility and fearful rapidity with which the inflammation, through the medium of the tendinous grooves, (coulisses,) sheaths, and synovial membranes and the exceedingly loose lamellar tissue upon the dorsal and palmar surfaces both of the phalanges and hand ; is propagated in the direction of the wrist, attacking at the same time the soft parts, the articulations and the surface of the bones, which in this manner soon become the seat of a suppuration which nothing can arrest.

To dilate (débrider) the fibrous sheath of each finger amputated, as is recommended by Garengot, (*Opérat. de Chir.*, t. III., p. 432,) J. L. Petit, (*Malad. Chir.*, t. III., p. 208,) and Bertrandi, and as has been again recently advised by M. Barthélemy, (*Journ. Heb. Univ.*, t. XII., p. 429,) would in no manner prevent the development of those formidable phlegmasias, which besides are totally disconnected with every kind of strangulation. M. Champion has on two occasions subdued the inflammatory accidents which supervene after amputation of the fingers, by means of caustic potash applied to the palm of the hand ; but when cataplasms or the vigorous application of leeches do not arrest their progress in the beginning, there is nothing which can prove really efficacious but numerous and deep incisions. The remedy is painful, undoubtedly, but it is a question of life and death ; and every one who has had an opportunity of witnessing their sometimes almost miraculous effects will not hesitate an instant in resorting to them.

ARTICLE II.—AMPUTATION OF THE METACARPUS.

Like the fingers, the bones of the metacarpus may be amputated in their continuity or at their articulations, and separately or all together ; they may also be exsected or even extirpated (extirpés.)

§ I.—*In their Continuity.*

Though the case may be rare in which we may have occasion to amputate the first and last bone of the metacarpus in their continuity, it is not so with those which support the fore, middle, and ring finger.

A. *Anatomy.*—The bones of the metacarpus, enlarged at their two extremities, incurvated in front, convex and wider on their dorsal surface, which is covered only by the flattened tendons of the extensor muscles of the fingers, and by cellular tissue, veins and skin, and separated by spaces of less width near the wrist than elsewhere, constitute in their ensemble a sort of grille (or grating, *i. e.*, grillage)

protuberant (bombé) behind, and the concavity of which is occupied by the inter-ossei muscles, the tendons of the flexors, the lumbricales muscles, the two arterial palmar arches of the hand and their branches, the distribution of the median nerve, the muscles of the thenar and hypo-thenar eminences, and the palmar aponeurosis and common integuments. Though scarcely moveable at their posterior articulations, they may however be approximated so as to incline towards each other in front at their digital extremities; from whence it follows that after having sawed obliquely through their middle portion, we are enabled to efface in a great degree the chasm which results from it, and that the deformity produced by this kind of amputation is much less than from the removal of one of the fingers. As their phalangeal extremity is in a state of epiphysis to the age of six or ten years, we may in children, and if the disease requires it, amputate one or all the fingers, by means of the bistoury. At a later period the saw becomes indispensable.

B. Operative Process.—The chisel, gouge and mallet, have, as in amputation of the fingers, been employed though more rarely for the removal of the metacarpal bones.

I. Partial Amputation.—In the hand, we must sacrifice nothing unless compelled to do so. Briot (*Progrès de la Chirurgie Militaire*, p. 127,) has often seen, and many times himself performed an amputation of a portion of the hand with success. “We have often,” says M. Larrey, (*Clin. Chir.*, t. III., p. 609,) “not had it in our power to save anything but the thumb alone, or the thumb and little finger, or the two or three last fingers of one hand, but they constitute hooks that are extremely useful to the patient.” In a case where the hand was crushed, M. Champion obliquely divided the four first bones of the metacarpus, after having disarticulated the thumb, and preserved the little finger. “This little finger,” says the author, “performs important services as a hook.”

a. The Ancient Process.—The parts being arranged, and held as for amputation of a single finger, the operator traverses, at some lines beyond the disease, the whole thickness of the hand from its dorsum to its palmar surface, then directs the point of the bistoury, held in the third position, upon the bone itself perpendicularly; inclines it a little to one side while drawing upon the skin; then straightens it (*redresse*) to graze the surface of the bone; approximates it to the median line when its point reaches to *the outside*, and terminates by cutting towards himself with the entire edge of the instrument (*à plein tranchant*) as far as to the middle of the corresponding inter-digital commissure. After this first incision, one precisely similar is made upon the opposite side, but in such manner that the two form but one only behind; that is to say, that the thumb and forefinger hold the tissues apart to the left, while the bistoury, carried back to the commencement of the wound, glides from the other side to fall also into the same division in front. We then divide what remains of the soft parts about the bone, by passing around its entire circumference with the point of the in-

strument. A thin piece of light wood, sheet-lead, or pasteboard, or a thick compress is then inserted deep in the wound, to prevent the saw which must divide the bones, from before backwards by a long bevelled section [*i. e.*, shelving, or slanting, or sloped—*en biseau très allongé*] from wounding the flesh. This bevel (*ce biseau*) in consequence of the kind of motion peculiar to the carpo-metacarpal articulation, must be placed upon the ulnar side for the two last fingers, and on the radial side, on the contrary, for the two first.

When the bistoury has not been carried too far outwardly, the collateral arteries are not usually wounded except at the root of the finger; in the contrary case, we run the risk of wounding their common trunk to the right and left, which, nevertheless, does not generally prevent us from dispensing with the ligature or torsion.

In dressing, it suffices to keep the lips of the wound gently approximated by means of some strips of adhesive plaster applied transversely, and three or four turns of bandage. In trying to obtain a perfect coaptation, we make traction upon the posterior articulations, but this is calculated to give rise to the train of formidable evils pointed out above. This operation, which is not appreciably more difficult than the disarticulation of a finger, makes a bleeding surface or wound three or four times larger, and necessitates the division of soft parts that are more delicate and far more numerous; so that in this respect, at least, it is certainly much more serious, nor should we have recourse to it unless after ascertaining that the other will not suffice.

b. *New Process*.—I have long substituted the following for the ancient process. An assistant separates the fingers apart, and holds the hand. Embracing the diseased finger with my left hand, I make an incision drawn obliquely from the posterior to the anterior articulation of the metacarpus, so as to go around the entire root of the finger. Setting out from the point where this terminates, another incision on the other side proceeds to join the former at a very acute angle on the back of the hand, as in the ovalar method. I afterwards isolate the bone on its sides and palmar surface, to beyond the diseased portion. I had at first used the rowel-saw (*scie à molette*) to divide from the dorsum to the palm of the hand, but M. Liston's pliers enables us to perform the section with far greater facility. Using this instrument, all the soft parts in the palm of the hand are protected from injury, and the operation is at once easy and rapid. None of the five patients upon whom I have used these pliers have had any accidents follow, and everything shows that the bone thus divided heals as well as after the use of the saw.

This process, should it be generally adopted, will rarely make it necessary to disarticulate the bones of the hand. By this process, the operation performed by M. Simonin, (*Décade Chir.*, 1838, p. 52,) to remove the second bone of the metacarpus, would have been made very easy and very simple. It is, after all, only an improvement of the ovalar method, and especially of the process long since

employed under similar circumstances by M. Langenbeck, (Rust's *Handbuch der Chir.*, t. I., p. 641.)

II. *Amputation in mass*, (en masse.)—a. Louis (*Mém. de l'Acad. Roy. de Chir.*, t. II., p. 272) made the section of the greater part of the bones of the metacarpus, in such manner as to leave only their posterior portion, in the case of a young girl, who was quite satisfied in having this mere vestige of the hand preserved. It would be better still should their anterior extremity (leur tête) alone be diseased, to divide them all in this manner transversely, rather than to disarticulate them. The operation could not present any great difficulties. A semi-lunar incision, with the convexity anteriorly, would lay bare their dorsal surface; a narrow knife, passed between the bones and the soft parts, from one border of the hand to the other, would form a palmar flap of from twelve to eighteen lines in length; a bistoury would then divest each bone of the tissues that surround it, in order to render the section with the saw more neat and easy.

b. *A Single Palmar Flap*.—In such cases, M. Van Onsenort makes in the palm of the hand, placed in supination, an incision near the fingers, with its convexity anterior, and comprising the entire thickness of the soft parts. From each extremity of this incision, he makes another which is oblique, and which are directed respectively to the radial and ulnar borders of the wrist. The upper extremity of these are united by a transverse incision, which divides through the whole of the tissues on the dorsum of the metacarpus. We then, by means of a narrow bistoury, isolate the bones from their muscles and periosteum; hold back the divided parts by means of a retractor (relevetur) bandage with five tails, and then saw through the bones.

c. *A process* much more simple, and one to which, considering all the circumstances, I give the preference, consists, after the dorsal flap is formed, in denuding each bone upon its sides, and then dividing them successively with Liston's pliers, before making the palmar flap.

§ II.—*In the Contiguity.*

A. *Partial Amputation*.—All the bones of the metacarpus may be separately disarticulated and amputated, together with the finger which corresponds to them. This may be done with the whole together, or with the four last only, and by a single stroke. But it is almost exclusively on the first and fifth that disarticulation is performed, since it is more easy to amputate the others in the continuity.

I. *Metacarpal Bone of the Thumb*.—From the mobility of this bone, and its shortness, we rarely think of dividing it by the saw when diseased, but prefer disarticulating it. Nevertheless, if its anterior extremity was alone affected, I see no reason why we should not divide it immediately posterior to this. There can be no particular danger in this operation, which, moreover, would not be difficult, and might be performed either by the flap or circular method, and would differ from amputation of the fingers at the

joint in this particular only, that it would require the intervention of a cut of the saw, or a stroke of the cutting pliers, to finish it.

a. *Anatomy*.—The metacarpal bone of the thumb which, upon its dorsum and outside, is scarcely covered except by the skin, and which is concealed in front by the whole thickness of the thenar eminence, presents, near the carpus, relations which it is important should be noted. The articulation of this bone with the trapezium being situated obliquely in relation to a line which would extend to the root of the little finger, and presenting, in some sort, a mixed character between the hinge (ginglyme) and enarthrosis, (énarthrose,) and surrounded with a very loose capsule, may be reached upon all the points of its circumference, but principally at its two posterior or dorsal thirds. The tendons of the extensor ossis metacarpi pollicis, (long abducteur,) and of the abductor pollicis manus, (court extenseur,) occupy and support its cutaneous region; while the radial artery passes around its ulnar side in going to the palm of the hand to form the deep-seated palmar arch. As to the tendons of the extensor secundi internodii pollicis, (long extenseur,) and of the flexor longus pollicis manus, (long flechisseur,) their position in front and behind is too well known to require any particular notice here. We determine the position of the articulation by gliding the forefinger from before backwards, either upon the dorsum or on its sides, as it is immediately behind the first osseous tubercle we encounter.

b. *Operative Process*.—We may disarticulate the first metacarpal bone by a great variety of methods, and with ease in whatever way we do it, provided we possess any address or skill.

I. *Ancient Process*.—If the surgeon is not ambidexter, the hand of the patient should be held in pronation for the left side, and supination for the right; in the contrary case, it is placed in pronation for both sides. While the assistant holds the wrist with one hand, and the root of the four last fingers with the other, the operator seizes hold of the thumb, which he carries into abduction; then directs upon the middle of the commissure the cutting edge of the bistoury, held in the first position, with its point upward; divides with its entire edge (en plein) the whole thickness of the soft parts, grazing from before backwards the ulnar border of the bone as high up as to the carpus; prolongs from four to six lines towards the wrist the incision of the teguments upon the dorsal and palmar surfaces; opens into the joint by inclining the bistoury outwardly; divides all the fibrous parts with the point rather than with the body of the instrument, in order that he may avoid wounding the skin; reverses the thumb at the same time upon its radial border, luxates it, and after having divided the articulation, cuts the flap from behind forward, grazing the outside of the bone until he reaches to within some lines in front of the metacarpo-phalangeal articulation. To preserve to the flap, especially at its base, the required width and thickness, it is advisable, while cutting through the inter-osseous space, to incline the handle of the instrument a little towards the hypo-thenar eminence, and to direct its cutting edge

towards the pisiform bone, or the ulnar border of the carpal extremity of the radius. In prolonging the wound of the skin to some lines beyond the carpo-metacarpal articulation, we obtain a means of disjuncting the bones with ease, without notching (échancrer) or hacking (découper) the margins of the flap which is to cover the wound.

If we have wounded the radial artery itself, we apply the ligature to it. The exact coaptation of the surfaces renders this resource unnecessary, when there have been no other arteries divided but the branches on the thenar eminence. After having applied the adhesive plasters, it is well to place a mass of lint or a graduated compress upon the outer surface of the flap, the base of which especially must be strongly pressed against the second metacarpal bone.

2. *Another Process.*—An assistant holds the thumb; the surgeon with the three first fingers of his left hand seizes hold of as much of the soft parts and draws them as far outwardly as possible; plunges in the bistoury by puncture from the dorsal surface of the hand to the palmar surface of the thenar eminence, grazing the radial side of the articulation; cuts out a flap as in the preceding process, reverses it backwards, and causes it to be held up by an assistant; he then himself takes hold of the thumb; causes the lips of the wound to be held apart; divides the joint from without inwards, luxates the bone and brings the bistoury back to terminate the operation at the point where it should have commenced in the other process. As the final result is precisely the same in the two processes, and as it is always less easy to disarticulate by this mode, which as it appears is still followed by M. Walther, (Rust's *Handb. de Chir.*, t. I., p. 642,) we should give the preference to the first.

c. *Process of the Author.*—In the place of making the flap by cutting from within outwards, we may proceed in the opposite direction, that is, commence with the section of the integuments, and reverse it afterwards by dissecting it from its apex to its base; this would be a more certain means of giving it as much regularity as possible, and the proper dimensions desirable, only that it would require a little more time. In actual practice we obtain in this manner a result infinitely preferable to the processes above described.

4. *New Process.*—I have frequently, in amputating the thumb, adopted the following mode. A dorsal incision carried from the styloid process of the radius to the middle of the commissure between the two first fingers, [*i. e.*, between the two first metacarpal bones. T.] and comprising the teguments, the tendon of the extensor secundi internodii pollicis, with a part of the first inter-osseous muscle, lays bare at first the articulation. While an assistant holds open the lips of the wound, the surgeon divides the ulnar side of the capsule, luxates the bone, and passing the bistoury underneath, separates it from the thenar eminence by cutting the soft parts from behind forwards and from within outwards. The palm of the hand being respected by this mode enables us to give to the flap the form and

extent we may require, and without any special obstacles to overcome.

5. *Ovalar Method*.—Lassus, Béclard, and M. Richerand, have long since described the oval method for the amputation under consideration. The operation is commenced as I have pointed out. The incision passes round the anterior surface of the root of the thumb, [*i. e.*, the palmar,] to ascend upon the outside to its dorsal surface, and unite this second incision to the extremity of the first. In the second stage the point of the bistoury is directed upon the articulation which is divided from its dorsal to its palmar surface; after which nothing remains to be done but to detach the bone from the soft parts which are adherent to it, by gliding the instrument in front of it from behind forwards. By this means we obtain an oval wound which is elongated to a great extent, and the lips of which may be united with the greatest degree of facility, so as to leave between them nothing but a linear cicatrix. It is the best and most simple of all the processes known, but not quite so easy as the preceding, which moreover accomplishes the same results.

II. *The fifth Metacarpal Bone*.—The bone which supports the little finger is disarticulated and removed by the same processes as those described for the thumb. Its articulation with the unciform bone (*l'os crochu*) presents this remarkable peculiarity; that it inclines obliquely in the direction of a line which would strike in front of the articulation of the trapezium with the first metacarpal bone, and that it is united to the metacarpal bone which supports the ring finger by an articulation (*facette*) which is nearly flat (*plane*) and by two or three ligamentous *bandelettes*. This articulation is recognized upon the outside by passing the point of the fore-finger along the dorsal surface of the last metacarpal bone, since before reaching the line of the pisiform bone we meet with a slight protuberance, then a small depression which is exactly upon the inter-line of the articulation.

a. When we follow the ancient process we need have no fear of the bistoury catching (*s'engager*) as it does in amputating the thumb between the bones of the carpus. We must therefore carry it unreservedly as far as to the unciform bone by grazing the radial surface of the fifth metacarpal, and directing the edge of the instrument towards the median line of the wrist, so as to preserve almost entire the hypo-thenar eminence. When the inter-metacarpal ligament is divided, the point of the bistoury, which is then to be inclined towards the ulna, readily enters into the articulation. In proportion as the other fibrous tissues are divided, the finger is to be reversed upon its ulnar border, that the instrument may escape from the articulation, to form the base of the flap cutting out the latter from behind forward, and prolonging it beyond the metacarpo-phalangeal articulation, while the little finger in the meanwhile is brought nearly into its natural position.

b. *The second process* in which we commence in forming a flap by plunging through the soft parts from one of the sides of the

hypo-thenar eminence to the other, before having separated the fifth from the fourth metacarpal bone, is in this part of more easy and advantageous application than upon the other border of the hand. The soft parts which naturally make a very considerable prominence on the outer part of the bone which we are about to remove, enable us by this means to cut out a thick flap of sufficient width; but the disarticulation is also more difficult than by the preceding mode.

c. The process which I sometimes employ for the metacarpal bone of the thumb is not applicable with the same advantage to that of the little finger, where the ovalar method is evidently preferable. The incision, commencing in front of the styloid process of the ulna, is carried obliquely forward to the root of the little finger, passing round its palmar surface from its ulnar to its radial border. We stop at the commissure in order to re-apply the bistoury at this point in order to prolong the incision backwards to unite it at an acute angle (en pointe) with the beginning of the first incision.

We might, moreover, begin just as well by falling on the commissure between the two last fingers, and terminating with the inner incision. As to the disarticulation, it presents nothing peculiar, and does not require any other notice.

III. *The Middle Metacarpal Bones.*—Without being impracticable, the disarticulation of these three bones is, nevertheless, it must be conceded, much more difficult than that of the two first; also amputation in their continuity is generally preferred to their disarticulation. If, however, we should desire to have recourse to the last, it may be performed either by the flap or ovalar method.

A. *The Flap Method.*—1. *Metacarpal Bone of the Fore-finger.*—The bistoury directed from before backwards, and from the commissure towards the carpus, soon reaches the ligament which unites the metacarpal bone of the fore-finger to that of the middle finger. We then raise the handle to divide the dorsal ligament, and then depress it to cut the palmar; the finger is inclined towards the thumb, the articulation entered, then separated by the point of the instrument, and the operation finally terminated by forming upon the radial side of the bone a flap which is prolonged until it reaches beyond the metacarpo-phalangeal articulation.

2. *Metacarpal Bone of the Middle Finger.*—The bistoury is applied between the two middle fingers. Before proceeding to the disarticulation, the wound must be prolonged in front and behind upon the wrist to the extent of half an inch, slightly approximating to the median line. This articulation is somewhat oblique in the direction from the ulna to the radius and from before behind, for which reason the operation would be rendered much more difficult if we commenced upon the other side. When the dorsal and palmar ligaments are divided, and when the bone which we are about to remove is separated from the metacarpal of the ring-finger, we act upon its anterior extremity as if for the purpose of luxating it backwards, and then endeavor, while an assistant draws the lips of the wound towards the thumb, to disarticulate (dégager) its carpal extremity, upon which, moreover, is inserted the tendon of one

of the radial extensors of the carpus, (un des radiaux externes.) This being accomplished, the bistoury is glided with its entire cutting edge (à plein tranchant) along the outer surface of the bone to the commissure of the fore and middle finger.

3. *For the fourth metacarpal bone, (i. e., the metacarpal bone of the ring-finger,)* we must direct the bistoury upon the same space; prolong the incision in the same manner posteriorly, with this difference, however, that it must be inclined towards the ulna; we then separate the two contiguous osseous articulating surfaces, and divide the ligaments as in the preceding mode, calling to mind that the articulation of the metacarpal bone of the ring-finger with the os magnum and the os unciniforme (os crochu) is oblique from without inwards and from before backwards, and that it is also continuous with that of the fifth metacarpal. In traversing the whole palm of the hand by two parallel incisions which are united posteriorly by means of oblique Λ incisions, M. Rust (Rust's *Handbuch der Chir.*, t. I., p. 653) may perhaps render the operation more easy, but it produces a larger wound, and one which is manifestly more difficult to heal.

B. *The Ovalar Method.*—M. Langenbeck (Rust's *Handb. der Chir.*, t. I., p. 654) was the first who successfully extirpated one of these bones by the ovalar method. The operator divides the integuments on their dorsal surfaces, by commencing at half an inch beyond the carpal articulation; he prolongs his incision to one of the digital commissures, brings it back upon the opposite side by passing around upon the palmar surface of the root of the finger; then unites its two extremities by cutting from before backwards, or from behind forwards, after the same rules on the outer side of the bone which he is about to disarticulate. While an assistant separates as far apart as possible the two lips of the wound, the surgeon, with the point of the bistoury, and without using any force divides in succession the ligaments of the articulation; and with his other hand makes an effort to luxate the bone. When he has finally effected this last result, the bistoury is glided flatwise and horizontally, in order to divide from the carpus to the root of the finger all the soft parts which still adhere to its anterior surface.

M. Simonin; (*Décade Chir.*, 1831, p. 51,) in disarticulating the second bone of the metacarpus, in a patient of his who got well, combined the ovalar with the ancient process. The oval incision being made, this surgeon slit up (fendit) the palm of the hand, and found more facility by this mode in disarticulating the bone, removing with it the finger at the same time.

B. *Simultaneous Amputation.* When the whole hand is affected in such manner that the carpo-metacarpal articulation remains unimplicated, is it necessary to remove the wrist at the same time with it? To believe in dogmatic treatises on surgery, there should not be the least doubt upon this subject, or, to speak more correctly, none of them have paid any attention to this question; at the present time, however, this is no longer the practice.

In confining ourselves to the disarticulation of the metacarpal

bones, we preserve a greater length to the fore-arm, and a moveable portion of limb, and obtain incontestible advantages for the application of an artificial limb, (*des moyens prothétiques.*) M. Larrey (*Clin. Chir.*, t. III., p. 609) affirms that military surgeons have long employed this operation. M. Yvan (*Arch. Gén. de Méd.*, t. XIV., p. 293) also says that many of the military patients of the Hotel of the Invalids have undergone this operation, and have done well after it. On the other hand, I find in a thesis supported in 1803, detailed observations upon this subject. In many soldiers of the army of the Rhine, says the author, amputation was performed at the carpo-metacarpal articulation with the view of saving at least the thumb. J. B. J. A. Blandin, (*Thèse*, 1803,) who describes this operation, and censures it, says this kind of disarticulation is very difficult; that in one case purulent collections rendered it necessary at a later period to amputate the arm, and in another the fore-arm, and that both died.

Paroisse (*Opuscles de Chir.*, 1806, p. 218) also in a patient of his, was enabled, by confining himself to the extirpation of the three last bones of the metacarpus, to preserve both the thumb and fore-finger. M. Delatouche, (*Thèse*, Strasbourg, 1814, p. 45-46,) who, in removing the fourth and fifth bone of the hand, was equally fortunate, says, that in fourteen or fifteen cases of this description, he has been enabled by this mode, to save a number of fingers. M. Mornay (*Thèse*, Strasbourg, 1816) maintains the advantage of saving the thumb at least. Troccon, who thought himself the author of this operation, repeated it a great many times upon the dead body, and presented a careful description of it to the Institute, which obtained a somewhat favorable report from Percy and Pelletan. At a later period, M. Maingault, (*Nouv. Méth. pour Amputer la Main*, &c.) in 1822, endeavored anew to draw attention to it, without mistrusting, as it would seem, that any person had spoken of it before him. Since the treatise of Troccon, M. Gensoul (*Arch. Gén. de Méd.*, t. XIV., p. 293) has performed it with entire success at the Hôtel Dieu, of Lyons, preserving only the thumb. Before him M. Guthrie had amputated the two last fingers and their corresponding metacarpal bone. M. Walther (*Ibid.*, t. XXIV., p. 135) has also performed this operation for the second and third finger in one case, and for the third and fourth in another, (*Graefe und Walther, Journal*, Vol. XII., 1829.) Finally, Troccon advanced the idea that it would be practicable to remove at the same time one or more bones of the first range of the carpus, and M. Benaben (*Revue Médicale*, 1825, t. I., p. 377) undertook to demonstrate the correctness of this opinion by successfully performing amputation upon the scaphoid, the trapezium, and trapezoid bones, and upon the metacarpal bones of the thumb and fore-finger. Two English (surgeons) also have claimed priority on these different points: the one, M. Sully, avers that in 1807, in a patient who is still living, he removed the last bones of the metacarpus, and also the unciform bone, the pisiform, (pisiformé,) and the pyramidal, (pyramidal.) The other, M. Radioré, avers, that in an infant of nine years of age,

in whom he removed the three middle metacarpal bones and the *os magnum*, (*os grande*,) he preserved only the thumb and little finger.

As often as we can preserve the thumb or any of the fingers, there is no doubt that we ought to adopt the process of these practitioners, and follow the advice of Troccon and M. Maingault. As a general rule, the carpo-metacarpal disarticulation should be preferred to amputation of the wrist. But it is an operation which exacts practice and an intimate knowledge of anatomy; so that if the surgeon does not feel sufficiently confident of himself to perform it without fear, he ought not to undertake it.

I. *Anatomy*.—We have already spoken of the arrangement of the first and fifth bone of the metacarpus, with the trapezium, and unciform bones. The metacarpal bone of the fore-finger, which is but loosely attached on its outer border to that of the thumb, but more firmly united on its inside with the third metacarpal bone, presents posteriorly on its outer side, a tubercle which is prolonged some lines towards the wrist, and gives attachment to the tendon of the extensor-carpi-radialis-longior, (*premier radial*.) [For *all* the muscles, see Table at the beginning of Vol. I., this American Edition. T.] Its posterior articulating surface is articulated on its outer portion with the trapezium, and on its two inner thirds with the anterior articulating surface of the trapezoid bone, which is found incased there, as it were, in a sort of triangular cavity.

The third bone of the metacarpus also presents a tubercle which projects (*tend à glisser*) beyond the interline of the *os magnum* and the trapezoid bone, upon which tubercle is inserted the tendon of the extensor-carpi-radialis-brevior, (*second radial externe*.) Its posterior articulating surface, oblique from without inward, rests in almost its whole extent upon the corresponding surface of the *os magnum*; while the articulating surface of the fourth metacarpal bone, oblique internally and posteriorly, is united with the radial half of the anterior articulating surface of the *os unciforme*, and then with a similar articulating surface (*facette*) which is presented by the *os magnum* anteriorly and on its inner side.

All these bones, on their dorsal surface, are kept in contact by ligaments in form of longitudinal and transverse narrow bands, (*bandelettes*,) and on their palmar surface by ligaments much more irregular in form, and also by fibrous bundles (*trousseaux*) which fill up the spaces which the points of the posterior extremities of these bones leave between them in front. Their synovial sheath is continuous, moreover, with that of the carpus, and is extended consequently between the two ranges of bones of this part; so that inflammation of the osseous surfaces as a consequence of the amputation we have been treating of, must, as a matter of course, be of a very formidable character.

In reviewing all these articulations upon their dorsal surface, we see that that of the first metacarpal, oblique anteriorly and internally, terminates at one or two lines in front of (*au devant*) that of the second, the interline of which latter goes at first almost directly backward, becomes nearly transverse before leaving

the trapezium, then turns round into a semilunar direction, with its convexity backwards on reaching the trapezoid bone, (trapezoïde,) and afterwards again passes obliquely backwards before abandoning this bone and uniting itself with the third metacarpal. The articulation of the third metacarpal bone commences at half a line nearer the wrist than the extremity of that of the second, and inclines obliquely inwards and forwards, as if to rest (*pour tomber*) upon the posterior fourth of the fifth metacarpal: it terminates, moreover, at two or three lines nearer the fingers than the commencement of the articulation of the fourth, which last at first follows such a direction, that if prolonged, it would become blended (*irait se perdre sur*) with the pisiform bone; afterwards it becomes almost transverse on arriving at the os unciniforme, and is continuous, but in some sort without any line of demarcation, with that of the last metacarpal, which is also very slightly oblique posteriorly.

The manner of identifying externally the first and fifth of these articulations having been pointed out above, it is, as I conceive, unnecessary, to recur to it here.

II. *Operative Process.*—A. *Method Adopted by the Author.*—An assistant supports the fore-arm, while he makes pressure at the same time upon the radial and ulnar arteries. The hand of the patient, turned in pronation, is embraced by the operator, who confines himself to holding the four last fingers, when he wishes to preserve the thumb; with a straight bistoury, or a small knife, we make a semicircular incision, with its convexity forward, about half an inch in front of the articular line we have just described. The assistant draws the skin back towards the fore-arm. With a second cut of the bistoury, the surgeon divides all the extensor tendons, and proceeds immediately to disarticulate, commencing on the radial side if he operates with the left hand, and on the ulnar side, on the contrary, if he operates on the right. The point of his bistoury should merely be drawn over the whole extent of the dorsal surface of the articular interline, for there is no need of penetrating the joint in order to divide the ligaments. If we begin by the thumb, its cutting edge will be first directed from behind forwards and from without inwards; then almost directly backwards; afterwards transversely, obliquely forward, (*en devant*;) obliquely backward, (*en arrière*;) then forward again through the whole extent of the articulation of the os magnum, with the third metacarpal bone, very obliquely backward upon arriving at the fourth, almost transversely to separate this last, and in such manner as to follow the same direction for the separation of the fifth metacarpal from the os unciniforme. During this manipulation, a certain degree of force is exerted upon the anterior extremity of the hand, as if for the purpose of luxating it.

All the articulations being now laid open, the point of the bistoury is used to complete the section of the fibrous parts which may still hold them together. When these are all completely separated, the knife is glided gradually towards the palm of the hand, and being turned flatwise, cuts out a semilunar flap of an inch or an inch

and a half in length, grazing, as it proceeds, the palmar surface of the metacarpal bones which are to be removed. The terminating branches of the radial and ulnar arteries have necessarily been divided. Those of the first are found upon the dorsal surface of the wrist, and near its radial border; the second must be sought on the inner side of the pisiform bone. Immediate reunion, which is in some sort indispensably necessary, requires here the same precautions as after the simultaneous amputation of the four last fingers.

b. Process of M. Maingault.—The process which I have just described after having often made trial of it on the dead body, and which is founded upon the principles laid down by Troccon, is not the same as that of M. Maingault. This last-mentioned author proposes that the surgeon should commence by forming the palmar flap, with a small knife inserted between the bones and the soft parts, so as to pass a little in front of the projections of the unciform and trapezium bones, leaving untouched everything which appertains to the thumb. He afterwards makes a semi-lunar incision upon the dorsal surface of the metacarpus, at the distance of an inch from the articulation; then returns in front, (*revient en avant*;) and while an assistant draws the flap backwards, he directs the point of the bistoury upon the base of the first, [flap,] (*du premier*,) until he exposes the inter-articular line. After which he proceeds to the disarticulation from before backwards, commencing with the metacarpal bone of the little finger, or by that of the fore-finger, according as the operation is upon the right or left hand.

c. The trial which I have made of this process has convinced me that it is not in reality very difficult. From not being practised in it, however, or from its inherent defects, it has appeared to me that the other was much more convenient. The definitive result, however, it is seen, must be the same in both cases.

d. If the two last metacarpal bones, or the two first, only were to be removed, the operative process would have to undergo some modifications. It would be necessary, in the first case for example, to commence by a transverse incision a little in front of the articulations, then to make another parallel to the axis of the metacarpal bones, upon the dorsum of that which supports the little finger, in order to cut upon that part a dorsal flap, which is to cover the whole ulnar side of the wound after the operation. This being done and the disarticulation completed, we would terminate the operation by forming only a small flap, of one or two inches in length, which we should be obliged to separate down to its base in the palm of the hand, in order to be enabled to raise it in front upon the transverse branch of the wound. We should proceed in the same manner nearly for the removal of the thumb and fore-finger, or for the fore and middle fingers. Proceeding in this manner, M. Gairal, (*Journ. Hebd.*, 1835, t. III., p. 64,) in the case of a man who had a musket burst in his hand, was enabled to preserve the two last fingers. Another patient, operated upon at Nancy (Gairal, *Journ. Hebd.*, 1835, t. III.) by the same process, lost only the three middle metacarpal bones, while he preserved the thumb and little finger.

Should it be required to remove at the same time some of the bones of the carpus, there is no rule that could be laid down in advance; these nice operations must in general be left to the anatomical skill of the surgeon. M. Van Onsenoort, in amputating the inner half of the metacarpus, with unciform, pisiform, and pyramidal bones, cut out a single flap only upon the ulnar border of the hand. The patient got well, and preserved the use of his thumb and fore-finger, with the middle finger in a slightly ankylosed state.

ARTICLE III.—THE WRIST.

In our times, says Percy, it is only at Tunis, or among other barbarians, that they cut off the wrist by means of a large hatchet, driven by a weight falling from above between two grooved uprights, (*montants à coulisse*), or a heavy chisel, which is struck upon with a leaden hammer. Nor is there any one who any longer believes it necessary to amputate the fore-arm, when, in order to remove the totality of the disease, nothing more is required than to disarticulate the hand. Among the moderns, however, there are many surgeons who regard this last operation as exceedingly dangerous. The facts related by Slotanus, (*F. de Hilden, in Bonet*, p. 504,) Bartholin, (*Hist. Anat.*, cent. 5, hist. 63,) Paignon, (*Mém. de l'Acad. Royale de Chir.*, t. V., p. 504, 1819,) Leblanc, (*Précis des Opérat.*, t. I., p. 317,) Andouillet, (*Acad. de Chir.*, t. V., p. 505,) Hoin, (*Ib.*, p. 506,) Sabatier, (*Ib.*, p. 504,) Brasdor, (*Ib.*, p. 492,) Lassus, (*Méd. Opérat.*, p. 541,) M. Gouraud, (*Princip. Opérat.*, p. 79,) and other surgeons, who affirm that it is almost always successful, have not dispelled the fears which it formerly inspired, and which Schmucker (Rougemont, *Bibl. Ch. du Nord*, t. I., p. 56) still entertains.

§ I.—Anatomy.

The radio-carpal articulation, surrounded with numerous tendons and synovial grooves and membranes, offers, moreover, this remarkable peculiarity: that it is terminated at the extremities of its largest diameter, by the processes of the radius and ulna, which gives it a semilunar form, concave transversely, slightly concave also from before backwards, where is lodged a kind of head formed by the scaphoid, semilunar and trapezium bones, which are kept in place by the internal, external, posterior, and anterior ligaments. As the first range of the bones of the carpus diminishes (*s'amincit*) at its extremities, especially on the ulnar side, a line drawn transversely between the *apices* of the styloid processes, would naturally strike between this range and the second. The pisiform, the point of the scaphoid, the crest of the trapezium, and that of the unciform bone, rise sufficiently above the line of the palmar surface of the radius and ulna, to require also that they should not be overlooked at the moment of operating. The skin on the anterior surface of the wrist presents almost constantly three wrinkles, which may be of some service in regulating the direction of the instruments. One of them, and which is the most constant, is found immediately above the

thenar and hypo-thenar eminences, and corresponds to the line of division of the two ranges of the bones of the carpus; the second, which is noticed at four to six lines behind this, is over the line of the radio-carpal articulation, and the third still higher up, corresponds usually with the epiphysal (épiphytaire) line of the bones of the fore-arm. When these folds are not very obvious, it is ordinarily sufficient to flex the hand moderately to make them distinct.

§ II.—*Operative Process.*

The amputation of the wrist is performed only by the circular and the flap method. Owing to the arrangement of the articular surfaces, and the slight degree of thickness in the soft parts, the oval method is not applicable to this operation.

A. *The Circular Method.*—The surgeons of the last century having contented themselves with remarking that the amputation of the wrist was performed like that of the fore-arm and leg, without entering into any details upon the subject, it is to be inferred that they employed the circular method, described, moreover, with sufficient clearness by J. L. Petit, the only one pointed out by Lassus and Sabatier, and the one, we must confess, which still presents the most advantages and facilities. The assistant who holds the fore-arm, draws the integuments forcibly backwards. The surgeon seizes the hand of the patient, and places it in a state of flexion, while he makes his incision upon the dorsal surface towards the radius on the contrary, when he incises inwardly, and upon the ulna when he reaches the outside, and in extension at the moment the instrument is passing underneath. In this manner he makes a uniformly circular incision, at a large finger's width (à un grand travers de doigt) in front of the processes of the fore-arm, and confines himself at first to the section of the skin which it is easy to push back afterwards to near the joint. A second cut divides all the tendons upon a line with the retracted integuments. We then enter the articulation upon either one or the other side, taking the corresponding styloid process for our guide, and making the bistoury describe a curved line, with the convexity directed posteriorly.

Though the radial and ulnar arteries are readily found, and may be either tied or twisted, they are often left in the wound without this precaution, and without any hemorrhage resulting from it. As to the inter-osseous, it is too small to require the least attention. If the operation has been well performed, there will be found a sufficiency of integuments to enable us to bring them forward without any difficulty, and to cover the articulating surfaces completely. It is in these cases that Garengeot and Louis (Leblanc, *Op. cit.*, t. I., p. 319) advise the division of the tendinous sheaths to the extent of one or two inches, in order to prevent the formation of purulent collections. The inclined (declive) position of the stump at least seems, in these cases, to be imperiously demanded.

B. *The Flap Method.*—I. *Ancient Process.*—The army surgeons appear to have for a long time employed, and M. Gouraud in 1815

has described, a process which consists in making, on the dorsal surface of the wrist, a semilunar incision, with its convexity towards the fingers, and whose two extremities seem to be continuous with the styloid processes of the radius and ulna. An assistant then immediately draws back the cutaneous envelope, and the operator divides the bridles which unite it to the subjacent tissues. A second incision, made upon the line of the articulation, serves to divide all the extensor tendons and the posterior radio-carpal ligament. We then divide the lateral ligament and the tendons of the radial muscles, (muscles radiaux,) [see vol. I., Table of the Muscles. T.] and of the extensor-carpi-ulnaris, if they have not already been divided at first. Nothing more remains than to separate the joint with a narrow knife, which is glided in front of the carpus, so as to terminate by cutting out a palmar flap of about an inch in length. Some surgeons recommend giving this flap a length of two inches from its root, and consequently to obtain a portion of it from the thenar and hypo-thenar eminences. Should we have been enabled to preserve a sufficiency of skin in the beginning, this precaution would be more injurious than serviceable. To cut it with facility, and to give it all the regularity possible, the cutting edge of the instrument must be inclined in good season towards the integuments, in order not to strike against the osseous projections of the carpus, and that we may remove the pisiform bone at the same time with the hand. Should the flexor tendons, which form in that part a bundle of considerable size, make any resistance, we ought not to hesitate to direct the instrument under them, in order to divide them transversely. The approximation and reunion of the lips of the wound will be thereby rendered more easy.

This process, which is as prompt as it is simple, has the advantage, should the soft parts posteriorly be degenerated, of enabling us to preserve a sufficiency of them in front to cover the whole wound; but it has the disadvantage of endangering denudation of the bony angles and their protrusion between the lips of the wound; for the thickest and widest part of the cutaneous flaps is situated precisely upon the concave and least salient portion of the articulation.

II. To cut the 2 flaps before opening into the articulation, as has been done by M. Walther, (Rust's *Handb.*, t. I., p. 609,) would perhaps give more regularity to the wound, but would not in any way change the character of the process. M. Rust, (*Ibid.*, p. 610,) who, by means of two lateral and two transverse incisions, gives a square or trapezoidal form to the dorsal flap, which he then raises up to divide the articulation, and to finish as in the ordinary process, has, it appears to me, rendered the operation thereby unnecessarily complicated.

III. *Process of M. Lisfranc.*—The operator, provided with a narrow knife, transfixes (transperce) the tissues on a line with the styloid processes, from the radius to the ulna or from the ulna to the radius, according as he is operating on the right or left limb; passes in this manner between the soft parts and the anterior sur-

face of the carpus ; then brings the instrument in front, and cuts out, as in the preceding case, a semi-elliptical flap of about two inches in length. This flap being raised up, or turned back, enables the surgeon to make, immediately after, upon the dorsal surface of the wrist, a semicircular incision nearly similar to that of the process which I have just described, and at the same time to divide the extensor tendons nearly on a line with the articulation ; then to disarticulate by passing under the point of one of the styloid processes ; thus terminating the operation as in the circular method.

IV. In describing the process which M. Blandin, (Jadelot, *Jour. Hebdom.*, t. III., p. 460,) on one occasion, adopted with success, the editors of Sabatier have, as it were unconsciously, added to it a slight modification. After having formed the palmar flap, in place of carrying the knife behind the wrist to divide the integuments there, they propose to divide the joint immediately from before backwards, and to finish with the division of the tissues which cover the dorsum of the carpus. Whether we adopt one mode or the other, this process presents nearly the same advantages and the same inconveniences ; that is to say, it is infinitely less convenient than the flap method usually followed, and, moreover, differs from it by such slight modifications as not to require any further notice.

V. The method of Rossi (*Elém. de Méd. Opér.*, t. II., p. 233) which proposes to make two flaps, one to the right and the other to the left, in the place of forming them in front and behind, also has no claims to our notice.

VI. At the wrist as elsewhere the surgeon is often guided by the condition of the diseased parts, much more than by the rules established upon the dead body. A man who had had the metacarpus and fingers contused by a cotton dresser (*batteur de coton*) exhibited upon the palm of his hand a large flap of sound tissues. After having abraded and regularized this flap, M. Champion, who has never had any occasion to regret having preferred extirpation of the wrist to amputating the fore-arm above it, raised it up to its place and effected the cure of his patient. In an army farrier, in whom a cancerous affection extended posteriorly to a line with the articulation, I was obliged to take the flaps from the outside and in front. The patient recovered.

VII. The borders of the wound should be approximated from before backwards. A roller bandage brought down from the elbow to the wrist, and long compresses for each side of the stump, protect the synovial membranes from inflammation and purulent collections. A slightly depending position best suits the wound. If an inflammatory engorgement should take place in the stump we must hasten to remove the bandages, and to substitute emollient topical applications, and antiphlogistic to the agglutinating means.

ARTICLE IV.—THE FORE-ARM.

The law that we should amputate as far from the trunk as pos-

sible, and save as much and take away as little of the parts as we can, and which is applicable to all amputations of the upper extremity, is more especially so to that of the fore-arm. J. L. Petit, (*Malad. Chir.*, t. III., p. 207,) Garengot, (*Opérat. de Chir.*, t. III., p. 441, 2e édit.,) Bertrandi, (*Opérat. de Chir.*, p. 471,) and more recently M. Larrey, (*Clin. Chir.*, t. III., p. 603,) influenced by false appearances or erroneously reported facts, have, notwithstanding, taken opposite ground. According to them, the lower third of the fore-arm is not sufficiently provided with soft parts, and has too many fibrous tissues to enable us to cover the bones conveniently after amputation, or to secure us against the thousand dangers from operations in this region. Its upper half, on the contrary, provided with numerous muscles, and having but few tendons, presents the conditions the most favorable for the success of such operations, and ought consequently to be selected by preference at the expense of sacrificing some inches of tissues that might if necessary have been saved. To this reasoning we may reply, that even the thinnest part of the fore-arm, and which is the most completely destitute of muscular fibres, will always enable us to preserve a sufficiency of skin to unite immediately and close the wound; that in point of fact (*en dernière analyse*) it is always the integuments which form the cicatrices, and that these integuments are at the same time so much the more preferable and more supple and solid, where there is the least quantity of muscle and tendon. It is a point, moreover, which experience seems to have now definitively settled, for I meet with no one who desires to make it a subject of controversy.

§ I.—*Amputation in the Continuity.*

The fore-arm, besides its 20 muscles, and their tendons, the radial, ulnar and inter-osseal arteries, their corresponding nerves, and the median nerve, and the aponeurosis, and the superficial veins which are distributed over its whole extent, presents also for consideration, 1, Its two bones moveable upon one another, and separated by a space which narrows as their extremities approximate, and which by means of a sort of [intervening] membranous diaphragm form the floor (*plancher*) for the anterior and posterior inter-osseous cavities and fossæ; 2, A series of decussating fibres (intersections *fibreuses*) and of abundant lamellar tissue between the different fleshy layers, whose intimate connections allow of but very little retraction, at the same time that the ensemble of these parts is as favorable as possible to the development of phlegmonous inflammations and purulent collections.

A. *Circular Method*.—All the processes of the circular method, as that of Celsus, the one by Wiseman and Pigray, those of Petit, Le Dran, Louis, Alanson or Desault, are those that have been most usually employed in amputation of the fore-arm. The most generally followed, however, at the present time, and the one which I think the best, is performed in the following manner:—

I. *Process adopted by the Author.*—An assistant placed upon the outside of the shoulder of the patient, who is supported upon the side of his bed, or seated upon a chair if he is not too weak, compresses the brachial artery against the humerus below the axilla, (See this volume, *supra*.) A second assistant, or the same one if we cannot procure another, seizes hold of the fore-arm turned in pronation, and holds himself prepared to draw back the skin towards the elbow. The limb which is to be amputated should at the same time be enveloped in linen and supported by a third assistant.

a. *First Stage.*—The operator, seated upon the inside, seizes with his left hand the fore-arm above the point where the skin is to be divided, if he is on the left side, and under it on the contrary, unless he is ambidexter, where he is to amputate the right fore-arm, and then makes a circular incision upon the integuments down to the aponeurosis, and at the distance of two or three fingers' breadth below the place where he intends to make the section of the bones. Should any cellulo-fibrous bridges interfere with the retraction of the teguments he rapidly divides them, and immediately bringing back the knife upon the outer and posterior surface of the radius, he makes a circular incision as at first, cuts through the whole thickness of the flesh as near as possible to the skin, first upon the dorsal region, then upon the palmar, and lastly upon the radial. In order that the soft parts may not shrink or retract, (*s'affaissent*,) instead of submitting to the action of the knife, it is necessary to effect their division by a saw-like movement of the instrument, which should not quit the surface of the radius before resting fully against the ulna, keeping the edge close to the surface of the latter bone as the incision is brought round upon the palmar surface, if we do not wish any part to escape or recede posteriorly. I have no need of adding that the same precaution is equally necessary for the remainder of the circumference of the limb.

b. *Second Stage.*—The divided muscles retract to a greater or less extent. The knife is now directed behind upon the dorsal surface of the ulna, and while the surgeon draws the instrument towards himself, its point as it proceeds falls upon the posterior inter-osseous fossa which it traverses to its depth, and divides, as it returns and comes round upon the posterior surface of the radius, every thing which it meets in its progress. It is now replaced underneath to complete in front what it had just effected behind, after which nothing more remains undivided around the bones.

c. *Third Stage.*—The middle tail of the compress, slit into three tails, is then immediately passed, by means of a forceps, through the inter-osseous space from the palmar to the dorsal surface. The soft parts being thus protected and drawn back, the surgeon proceeds to the section of the bones, commencing with the radius; he continues the section in such manner as to act at the same time upon the radius and ulna, but so as to finish upon this last bone.

d. *Fourth Stage.*—After the amputation of the limb, and the retractor compress is removed, the assistant charged with drawing back the soft parts, immediately relaxes them. We then attend to

the arteries, searching for them successively in the depth of the tissues. The anterior inter-osseal which is accompanied by a nervous filament, which it is well to avoid, is usually found upon the middle of the palmar surface of the ligament of the same name. The radial situated more externally and superficially, is seen between the supinator radii longus, the flexor carpi radialis and the flexor longus pollicis manus; it is besides so remote from the nerve that its ligature does not in this respect exact any special precaution. In order to find the ulnar artery with its accompanying nerve on its inside, we must look for it on the inner side of the arm and between the flexor carpi ulnaris, the flexor digitorum sublimis, and the flexor digitorum profundus. As to the posterior inter-osseal artery, which is distributed (s'éparpille) through the fleshy bulge (masse) of the extensor muscles, there is no need of troubling ourselves about it, unless amputation is to be performed at the upper half of the fore-arm.

e. Fifth Stage.—The lips of the wound are to be brought together from before backwards, and it is in this direction that the adhesive strips are to be applied. We thus obtain a transverse linear wound, whose angles embrace the bones, and have hanging out from them the ends of the corresponding ligatures on either side, while the end of the middle ligature is to be brought up directly in front.

II. *Process of Alanson.*—If the skin should be lardaceous, (lardacée) or have contracted morbid adhesions with the subjacent tissues, it would be better, after having made the circular incision through it, to dissect it up and turn it back upon its outer surface so as to form a ruff in the manner of Alanson and Brunninghausen.

III. *Anonymous Process.*—Should any difficulty be apprehended about dividing the muscles and tendons which are found at the bottom of the inter-osseous fossæ, we may, after the integuments are incised and raised up, glide the knife flatwise between the bones and the soft parts, and immediately after turn up its cutting edge outwardly, so as to cut transversely from within outwards all the soft parts on a line with the raised-up skin, and do this in succession upon both sides of the limb. It was M. Hervez de Chégoin, (*Mém. de l'Acad. Roy. de Chir.*, t. II., p. 273,) I believe, who in the year 1819 first published the suggestion of this modification, which M. Cloquet says he has often employed with success, (*Dict. de Méd.*, t. II., p. 153,) and which, from inadvertence no doubt, the editors of Sabatier had appropriated to themselves.

IV. All the muscles being divided, it is possible that we may desire to detach them still more, in order to be enabled to saw the bones higher up. In this case we detach with the point of the knife or bistoury the two borders of the inter-osseous membrane to the extent of some lines. Here, as in all other points of the limb, we ought to preserve so much the greater extent of integuments, as the operation is performed higher up, or to speak more correctly, in proportion as the volume of the part is more considerable. Nor must we forget that owing to the deep-seated muscles being inserted upon the bones nearly throughout their

whole extent, they retract but very little towards the elbow, and that it is therefore principally on the skin that we must rely for uniting the wound and covering the stump.

B. The Flap Method.—Circular amputation of the fore-arm generally succeeds very well, and allows the cure to be accomplished in the space of from three to four weeks. Nevertheless it has been proposed to substitute the flap method for it. In our own times it has still been employed by M. Graefe, in the manner recommended by Verduin and Lowdham, and as Ruysch says he has seen it performed, that is, by cutting a flap on the palmar surface of the limb and finishing the rest of the operation in the same manner as in the circular method. Vermale, Ledran, (*Opérat.*, p. 565, 569,) Klein, Hennen and M. Guthrie, prefer, on the contrary, making two flaps, one in front, the other behind. Under this point of view it would be difficult to withhold the preference from the process of Vermale, which is eulogized also by M. Langenbeck (*Rust's Handb. der Chir.*, t. I., p. 693,) and Rossi, (*Opér. cit.*, t. II., p. 233,) over that of Verduin. I have performed it and also caused it to be repeated upon the dead body by a great number of pupils. I have performed it on the living subject twice, and I am satisfied that it is generally less advantageous than the circular method, though the operation is easier and more quickly done. It is true that it is not then with the skin only but also with much of the fleshy fibres that we cover the extremities of the bones. The two flaps are sufficiently thick, and supplied with a sufficient abundance of cellular tissue to adapt themselves accurately together, and to furnish with security all that could be required for immediate union. To be enabled then to unite by first intention, each should have a length of about two inches. If the disease extends more on one side than on another, we need not make but one flap, or we may give them an unequal length. So that one does not perceive at first why this mode of operating may not be applied as low down as the circular method. Unfortunately upon examining it more attentively, it is perceived that most of these advantages are illusory. All the muscles cut with a sloping edge (*en biseau*) necessarily augment the traumatic surface. Being included within the thickness of each flap, they serve only to increase the danger of the inflammations which may be developed. The bones also are not the less exposed to protrude (*à s'échapper*) at the angles of the wound; and the most simple reflection makes it apparent, that, by a circular incision, an inch of integuments will more accurately close up a wound of two inches width from before backwards, than flaps one-half longer, because of the void which these latter constantly tend to leave at each side of their base. The following, however, is the operative process:—

I. Operative Process.—The limb being turned in pronation, and properly held, the operator cuts his palmar flap, by passing his knife from one side of the fore-arm to the other, between the bones and the soft parts, which latter he divides obliquely from above downwards (*de haut en bas.*) To form the dorsal flap, he draws the lips

of the wound backwards, replaces the point of the instrument in the upper part of the first division, causes it to glide posteriorly, and finishes with the same precautions as before. Directing the assistant to turn back immediately all the soft parts, he passes round the radius and ulna as in the circular method, cuts what may remain of the soft parts, inserts the retractor, (*la compresse fendue*,) and afterwards effects the section of the bones as in the usual mode.

II. *Remarks*.—By cutting the palmar flap first, we are enabled to give greater thickness to the dorsal, and the palmar surface of the fore-arm being turned downward, the blood which escapes at first, in no wise interferes with the remainder of the operation. Moreover this precaution is far from being indispensable. The important point is to obtain two flaps of nearly equal dimensions, and not to take off too much of their angles, (*de ne pas trop en dégarnir les angles*.) It is certainly remarkable that a military surgeon who, no doubt, in the movement of armies is prevented from keeping pace (*au courant*) with the progress of science, has conceived the idea of applying the ovalar method to amputation of the fore-arm, and of making the point of the oval fall upon the ulna ! The limb might be left in supination instead of placing it from the beginning in pronation ; but then the sawing of the bones would produce more concussion upon the joints and would not be as easy.

The radius and ulna are recommended to be sawed at the same time, so as to finish however on the last, because the ulna, from being more firmly connected with the humerus, supports the action of the instrument better than the radius could do. In directing the operator to place himself on the inside between the limb and the trunk, I have not pretended to lay down an invariable rule. Bertrandi (*Opér. cit.*, p. 473) remarks, that when the patient is in bed, if we did not place ourselves upon the outside, we should be little at our ease, at least for the right limb. The English and German surgeons, and among them M. Guthrie, are in an error in saying that the flap operation is only applicable to the upper part of the fore-arm. It is applicable to its entire extent. Ledran (*Opér. cit.*, p. 563,) had already remarked that a patient operated upon by him in this manner, recovered in twenty days, while by the circular method he did not obtain cicatrization under two or three months ; which, however, is in no respect remarkable, because at that time they were not yet successful after circular amputation in obtaining union by the first intention.

III. Reunion and the *dressing* are performed here in the same way as at the wrist, and the consequences of the operation exact the same precautions in both cases. M. Davidson performed this amputation successfully for an elephantiasis of the hand ; but M. Mussey, (*Gaz. Méd. de Paris*,) 1838, p. 394,) was obliged to amputate also the arm and afterwards the shoulder ; M. Baud (*Thèse* No. 142, Paris, 1831) has performed it, though there was a fracture of the arm ; in a patient of M. Blanche (Puchot, *Thèse* No. 207, Paris, 1835) no ligature was required ; and Hoeff (*Gazette Salut.*, 1787, No. 7) also performed it without tying the arteries.

§ II.—*Amputation in the Contiguity.*

Some surgeons of the last century, on the strength of a passage in Paré, (liv. XII., ch. 37,) who says he ventured to disarticulate the fore-arm that had become gangrenous in a soldier with a fracture, have supposed that by systematizing this operation, practice might derive some advantages from it, that among others of saving three or four more inches to the limb than in cases where amputation was performed on the arm itself; other facts confirm this remark. In a nun, says Cattier, (*Biblioth. de Planque*, t. V., p. 11, in 4to.,) who would not permit herself to be amputated upon the living part, the fore-arm ultimately detached itself at the elbow, and the patient recovered. A girl, (*Acad. des Sc. Hist.*, p. 41, art. 10, 1703,) in whom the two fore-arms had separated at the elbow, took them herself to the Academy of Sciences! But many of the moderns have objected that this advantage is of too trivial importance to be purchased at the risk of numerous difficulties and dangers of every kind which must necessarily accompany a disarticulation of this nature. If it be possible to cut from the soft parts a flap sufficiently long to cover the whole extremity of the articulating surface of the humerus, it must be equally practicable to do so in circular amputation immediately below the joint. In the contrary case it is remarked, that we ought not to decide upon leaving so large a cartilaginous surface exposed, and that amputation of the humerus would therefore become indispensable.

^{These} These arguments are less conclusive than they at first sight appear. Because the soft parts may be in a condition to be saved, it does not follow that the bones are sufficiently sound to allow of the action of the saw, or to preserve the least portion of them. Necrosis, caries, comminuted fractures, &c., may extend up to the articulation, and without the surrounding parts having entirely lost their primitive character. The diseased bones also being once removed, who does not know that the soft parts ultimately often become restored to their natural state? Moreover, the operation in itself less dangerous than amputation of the arm, is far from being as difficult as has been imagined. M. Rodgers, (Velpeau's *Anat.*, American translation, etc., annot., Vol. II., p. 520,) of New-York, and M. Chiari, (*Bulletin de Férussac*, t. XII., p. 275,) have performed it successfully, and Dupuytren has also had every reason to be satisfied with it. For myself, I consider it advisable, wherever the bones are diseased to the extent of an inch or two from the joint.

B. The *Flap Method*.—Owing to circumstances, or from necessity, Paré either has not, or but very obscurely, described, his method, supposing, without doubt, that any person could divine or imitate him.

I. *Process of Brasdor*.—After various trials, Brasdor (*Mém. de l'Acad. de Chir.*, t. V.) determined upon the following rules:—A semi-lunar incision, with its convexity downwards, and comprising the posterior half of the circumference of the limb, is first made at

some lines below the apex of the olecranon, in order to enable us to divide the lateral ligaments, and the tendon of the triceps, and to lay open largely the articulation of the radius. The knife then passed flatwise from one side to the other, between the anterior surface of the bones and the soft parts, forms a large flap whose base corresponds to the joint, and its apex to a point three or four inches below. Finally, we terminate by disarticulating the ulna from the coronoid process to the olecranon, and by the division of the triceps muscle, if that has not already been done in the beginning.

II. *Process of Vacquier*.—In the third Thesis in quarto, supported at the Faculty of Paris at the commencement of the present century, Vacquier proposes the following modification to the process of Brasdor: he commences by cutting with a double-edged knife the anterior flap from below upwards, as high up as to a line with the articulation; then divides the ligaments which unite the radius and ulna to the humerus; luxates the fore-arm, and terminates by detaching the olecranon from the large tendon which is inserted upon it, and from the integuments, so as to leave a flap of some lines in length behind.

III. *Process of Sabatier*.—Sabatier ascribes to Dupuytren the process by which it is considered more advisable to saw through the olecranon and leave it, rather than to remove it, and to form a flap of the character of that of La Faye for amputation of the shoulder, or of that of Verduin in amputation of the leg, rather than literally imitate the process of Vacquier.

IV. *Process of Dupuytren*.—According to MM. Sanson and Bégin, Dupuytren performed amputation at the elbow-joint seven or eight times successfully, by cutting a flap after the manner of Verduin, that is to say, by plunging a double-edged knife in front of the articulation, from one tuberosity of the humerus to the other, between the bones which he grazes and the soft parts which are raised up with the left hand, in order to divide them from above downwards. The disarticulation being effected, Dupuytren completes the operation by sawing through the olecranon, or removing it.

The difference between these various processes is much less than Vacquier supposes. The final result of all of them is nearly the same, except that that of the member of the ancient academy, being a little more tedious and difficult, ought to be laid aside.

V. *Process of the Author*.—I see no advantage in preserving the olecranon, as Sabatier advises, and as Dupuytren has frequently done. The triceps does not require it for the movement of the humerus, and it is evident that its preservation can in no way favor the success of the operation. For the saw to reach its anterior surface, it is necessary that the articular surfaces should be completely disjoined. No obstacle can then interpose to prevent our detaching it from the integuments which cover it behind. But supposing that there positively exists a wish to preserve it, the following modification has appeared to me to present some advantages. The limb is held moderately flexed, and in supination. With a knife with one cut-

ting edge only, we make an incision transversely on the upper part of the fore-arm, a little below the tuberosities of the humerus, in order to form a flap after the manner of Dupuytren. The assistant takes hold of this flap and raises it up. The operator then divides transversely, as in the circular method, an inch below the condyles, the teguments which remain behind; causes the skin to be raised up, returns in front, divides the external lateral ligament, and disarticulates the radius. Finally, after having carefully divided all the soft parts which surround it, he saws through the ulna, immediately below the anterior border of the coronoid process, as near as possible to the joint, and in a direction continuous with the humero-radial interline, (interligne,) [*i. e.*, the line of the inter-articulating surfaces of the humerus and bones of the fore-arm. T.] We thus avoid all the difficulties attending the disarticulation of the humerus, and the operation is as speedy as by any other mode; there is no need of making any traction or exertion upon the bones, and the wound, which has considerably less width, must be less disposed to suppurate, and more easy to unite by first intention.

VI. *Another modification*, applicable to all the flap processes, and which I should much prefer, would consist in cutting and dissecting the parts from the skin to the bones, instead of plunging the knife at first between the flesh and bones, as is the objectionable practice in amphotheatres.

B. *Circular Method*.—I have satisfied myself that circular amputation, in these cases, would offer decided advantages. An inch of integuments, preserved below the elbow, would be sufficient to cover the trochlea (poulie) of the humerus, while, by the flap method, there would be required three or four in front. All the muscles being sacrificed, the wound would in reality be less in extent, less disposed to an abundant suppuration, and cause less intense reaction upon the system. After having divided the skin circularly, I dissect it, and turn it back as high up as on a level with the joint, after which I divide the anterior muscles, then the lateral ligaments in order to disarticulate from before backwards, and terminate with the division of the triceps behind. The humeral [or brachial] artery alone requires tying or twisting, and the cutaneous ruff (manchette) [*i. e.*, the turned-back fold of skin. T.] may be brought down without the least difficulty in front, so as to close up the wound.

ARTICLE V.—AMPUTATION OF THE ARM.

Amputation of the arm, required most generally for some disease of the humero-cubital articulation, is usually performed below the middle part of the limb. As other affections, however, such as lesions of the humerus itself, may also exact this operation, we are sometimes compelled to amputate much nearer the shoulder.

§ I.—Anatomy.

The humerus, constituting the only bone in the arm, cylindrical

in its middle portion, twisted slightly (*légèrement contourné*) upon itself, and near the elbow flattened in such manner that its borders are felt naked under the skin, is also surrounded with numerous muscles. The deltoid, coraco-brachialis, long head of the triceps and the biceps, which are all attached to the scapula, together with the pectoralis major, and the latissimus dorsi, [see Table of Muscles, Vol. I.,] form a distinct system, whose retractile powers we must make allowance for when we are about to amputate above the deltoidal tuberosity. As these muscles are all inserted below the head of the humerus, M. Larrey came to the conclusion that, in amputating upon a line with the surgical neck, (*col chirurgical*,) the fragment of bone preserved would be of no use, but, in fact, hurtful, from being kept in a state of permanent extension by the supra-spinatus and infra-spinatus muscles. Below the deltoid-muscle, the biceps which extends from the shoulder to the fore-arm without any adhesions, is the only one after its division which can retract to any considerable degree; the others, the brachialis internus, and the three divisions of the triceps, having their fibres implanted upon the humerus itself, cannot retract but very little from the point where the knife has divided them.

§ II.—*Operative Process.*

If, like Petit, after having divided and raised up the skin, we should confine ourselves to dividing all the muscles upon the lower half of the arm at the point upon which the saw is to be directed, the biceps would rarely fail by its subsequent retraction to produce a denudation of the bone.

A. *Circular Method.*—The integuments are too moveable upon the aponeurosis to require the trouble of dissecting them and turning them back upon their external surface, as Alanson proposes. Among the processes then to be selected, there remains that of Celsus or Louis, modified by Dupuytren, and that of Desault.

I. *The Lower Half.*—The patient being seated, and the artery compressed, as in amputating the fore-arm, an assistant seizes the limb and raises it from the trunk at almost a right angle. The rule recommends that the surgeon should place himself upon the outside; but when we operate on the left arm there is some advantage in placing ourselves on the inside. With the left hand we draw back the skin in proportion as the instrument proceeds. The division of the integuments is made as near the elbow as possible. In incising the muscles circularly on a line with the retracted skin, it is important to cut through the whole thickness of the biceps. We may, in fact, after the manner of M. S. Cooper, divide, at first, this muscle only, in order to make the division of those of the deep-seated layer only, at a few lines from the point where we are to saw the bone. When the humerus is laid bare, it could not be otherwise than advantageous to separate the fleshy fibres from it parallel to its length, as was recommended by Bell, and as is still practised by M. Graefe. M. Hello (*Thèse* No. 258, Paris, 1829) also maintains

that the deep-seated fibres thus preserved are the only ones which can be brought down in front. I will add to this, that it is then necessary to dissect the skin, as recommended by Alanson; and afterwards to divide all the tissues perpendicularly and with a single stroke of the knife. In whatever manner we operate, we must take care that we do not wound the radial nerve. The last muscular layer should be divided at about three inches above the line of the division of the integuments. The retractor compress, and the section of the bone require no particular directions.

The brachial artery is found between the biceps and the inner portion of the triceps, close to (accolée) the median nerve, and between its two accompanying veins. The situation of the other two or three branches which require some attention, will be indicated by their bleeding. The practice of closing the wound from one side to the other, though there would, in fact, be a little less void to be overcome in closing from before backwards, arises from the preference that exists of having a cicatrix directed from before backwards, rather than transversely.

II. The *Upper Third*.—The biceps above the *deltoid depression*, being at this point nearer to its origin, cannot retract as far; but the volume of muscular tissues being much greater, it is as indispensable as it is lower down to save a considerable portion of integuments, and to favor their retraction as much as possible before making the section of the bone. (De la Faye (*Mém. de l'Acad. Royale de Chir.*, t. II., p. 241) had already proposed, and Leblanc (*Précis d'Opér.*, t. I., p. 328) combated the process advocated by M. Larrey, (*Clin. Chir.*, t. III., p. 560,) to wit: that it is better to disarticulate the humerus than to amputate it above the muscles, which connect it with the chest. The advice of Leblanc, Percy, (*Rapport à l'Institut sur la Desarticulation du Bras*), and Richerand, however, has prevailed.) Experience has proved that after the cure, the deltoid muscle, the pectoralis major, the latissimus dorsi, the teres major, and coraco-brachialis, are not without their action upon *this small extremity of bone* as De la Faye called it, and that they may execute various movements upon the stump. The small portion of the arm which remains, augments at least the protuberance of the shoulder, prevents the slipping of the suspenders, preserves the hollow of the axilla, and most usually allows of holding against the chest certain foreign bodies, as for example, a cane, and port-folio. “It is a constant source of satisfaction to me,” says M. Champion, “when I reflect upon the usefulness which a stump like this has proved itself susceptible of, in three patients in whom I had saved it.” Besides, it is not necessary then to open into the articulation, nor consequently to fill up the large cul-de-sac which exists between the acromion and the scapular tendon of the triceps muscle.

B. *Flap Method*.—The arm is the limb which appears to be the least favorable to the flap method; so much the more so as its rounded form and the position and small volume of its bone are

wonderfully adapted to the success of the circular method. Klein and M. Langenbeck, notwithstanding, have endeavored to bring the other into vogue. I have myself had recourse to it on two occasions on living man, and have often performed it, or caused it to be performed, upon the dead body. At the first glance, we might suppose that a great advantage could be obtained from it, for union by the first intention. By the flap method, it is not the skin only, as in the circular, but the muscles themselves, which cover the extremity of the bone and shut up the wound; in this we have nothing to fear from the retraction of the muscular fibres or the isolation of the cutaneous envelope; three incisions by the knife, one for each flap, and another for the denudation of the bone, and one division by the saw, complete the whole operation. Well! with all these advantages, the rapidity and facility of the manipulations are all that are real. The muscular mass to which so much value is attached, is, after all, calculated only to favor phlegmonous inflammation of the stump, with a constant tendency to slip from one side to the other, and, should suppuration ensue to ever so slight an extent, to protrude the bone through one of the angles of the wound. Nowhere, in fact, are the inconveniences of the flap method so conspicuous. Nevertheless, Sabatier himself advises it when we are obliged to amputate near the shoulder.

I. *Process of Klein*.—A narrow knife, plunged through the arm, from the radial to the ulnar side, and grazing the bone, cuts out a first semilunar flap of about two inches in length; after having formed another in the same manner upon the opposite side, both are raised up; we then divide at their base the small quantity of muscle still adherent to the bone, which last is sawed with the usual precautions. It is almost a matter of indifference also whether we begin with one flap or the other.

II. *Process of M. Langenbeck*.—The assistant raises up the integuments with force; the operator, seated on the inside, supports the lower part of the limb with his left hand for the right arm, and *vice versa* for the left arm; provided with a good knife in the other hand, he cuts with a movement (*en frappant*) from below upwards, and from the skin to the bone, an inner lap, which should have, as in the preceding case, a length of from two to three inches; then, in passing the knife and his wrist underneath, to bring them back in front of the arm, he is enabled thereby to form an outer flap similar to the first. I have seen young German physicians practise this process in our theatres, and execute it with the greatest celerity; but such exhibitions of power and address can possess no importance except in the eyes of those surgeons, who, like the pupils of MM. Langenbeck and Graefe, go for those only who, in amputations, operate with the greatest rapidity, and count even the seconds.

III. *Process of Sabatier*.—Sabatier recommends the flap method only in cases where the operation is performed so high up that it is impossible to employ the tourniquet. His process which had already been described by Leblanc, (*Opér. cit.*, t. I., p. 327,) con-

sists in forming, by means of a transverse incision and two longitudinal incisions, a flap, of the shape of a trapezium, at the expense of the antero-external portion of the deltoid muscle, then in raising this flap up, and by a circular incision, dividing the remainder of the soft parts before proceeding to the section of the bone. It is to be understood, moreover, in this case, as in all others, when the amputation is to be performed near the shoulder, that the compression of the artery should be made above the clavicle, or upon the second rib, as I shall point out farther on.

[*Artificial Arm.*—In cases where a fragment of the humerus is preserved, M. Von Peterssen, a Dutch sculptor, according to the report of M. Majendie, made to the Academy of Sciences of Paris, Feb. 17, 1845, (*Gaz. Méd.*, Feb. 22, 1845, p. 125–126,) has contrived an ingenious piece of mechanism, which, both in its form and articulations, representing the wrist, hand, and fingers, is made to execute by means of springs and the leathers, by which it is fixed to the stump and chest, a great number of the functions of a living, healthy arm, so as to become exceedingly useful in seizing bodies with the hand, lifting a tumbler, food, &c., to the mouth, in fact, performing a great number of the movements of flexion, extension, &c. The whole weight is but 500 grammes, and the cost about 500 francs or less. The examination made by the commission of the Academy (of which M. Velpeau was one) of persons who had had this apparatus substituted for one or both arms, proved highly satisfactory, and their report expresses unqualified commendation of the invention, in which favorable conclusions the Academy also entirely concurred. T.]

ARTICLE VI.—AMPUTATION OF THE ARM AT THE SHOULDER JOINT.

It is an error to suppose that disarticulation of the arm had not been ventured upon until the beginning of the last century. La-roque, (*Journ. de Méd.*, 1686, Juin, p. 3,) in the year 1686, relates a case of this operation. The limb had become gangrenous. “The surgeon took a small saw to amputate the humerus; but having perceived that the bone shook (*branlait*) near its articulation *with the shoulder*, he made a jerk upon it, (y donna quelque secousse,) when the bone readily escaped from its socket, (*boite*,) after which the boy was soon restored to his former health.” Though the idea must have often presented itself to the minds of surgeons, as to La Garcine, (*Bibliot. de Planque*, t. V., p. 9, in quarto,) the fear of opening into so large a joint, and the ignorance of the means how to suspend the course of the blood in the limb during the operation, together with the proximity of the trunk, had deterred the boldest practitioners from undertaking it. Le Dran (*Garengot*, 2e édit., tome III., p. 454; 1e édit., tome II., p. 382, 1720) is the first who has described it. His father had had recourse to it about the year 1715, (*Obs. de Chir.*, t. I., p. 315,) for a necrosis of the humerus, accompanied with copious suppuration, and completely cured his

patient. Since then, it has been pretended that Morand, the father, (*Opuscules de Chir.*, p. 212, 2e partie,) or Duverney, (Mihleew, *Elements of Surgery*, &c., 1746,) had performed it before Le Dran, but of this no satisfactory proof has been given. At the present time, the advantages of this amputation are no longer disputed by any one. It has been so often performed that it is useless to discuss its practicability.

§ I.—*Anatomy.*

The articulation of the shoulder being surmounted by two processes which extend beyond its line in front, and greatly augment its vertical diameter, presents an arrangement much more favorable for immediate reunion in a transverse direction, than from above downwards. In its union with the body of the bone the head of the humerus forms an extremely open angle, (*extrêmement ouvert*,) and the fibrous capsule is inserted a little upon the inside, (*en dedans*.) In the amputation it is necessary that the edge of the instrument should describe a circular line exactly corresponding (*semblable*) to the plane (*plan*) of the hand, if we desire to separate the fibrous tissues from it with facility. Finally, the glenoid cavity, surrounded with a tendinous border, having greater height than width, seems to be still further prolonged upon its upper part by means of the vault formed by the two processes just mentioned.

In proceeding from above downwards, we find about this joint, besides the common integuments and a very thin aponeurotic layer, the deltoid muscle, a loose cellular tissue, the tendons of the supraspinatus, infra-spinatus, sub-scapularis and teres minor muscles, together with the fibrous capsule and the tendon of the long division of the biceps; on the inside the coraco-brachialis and the other portion of the biceps; lower down the scapular portion of the triceps; then the brachial plexus and axillary vessels, and under the skin the pectoralis major, the latissimus dorsi, and the teres major muscles. Many of these parts may be readily recognized upon the outer surface. Thus the apex of the acromion is easily distinguished above the stump of the shoulder, and on the inside appears to be continuous with the clavicle. The coracoid process a little nearer to the thorax, and more prominent than the last mentioned bone, may also be very easily distinguished by the touch. In that part is found also a triangular space which may be made of practical value. Bounded on the outside and below by the head of the humerus, above by the clavicle and acromion, and on the thoracic side by the coracoid process, this space conducts directly into the articulation. The posterior border of the axilla, raised up and turned outwardly upon the side of the scapula, also enables us to reach below the acromion and to traverse the upper and outer part of the articulation. In some persons the acromion is much more prominent than in others. Sometimes also its anterior border is greatly depressed, so that its humeral side presents a very deep cavity. In infancy it remains a long time cartilaginous. In two

subjects, considerably advanced, that is to say, adults, I was enabled by a very slight effort, to separate it as an epiphysis of the spine of the scapula. These different anomalies being of a nature to render disarticulation of the arm either more easy or more embarrassing, should, as well as the other anatomical details which I have just given, be always present in the mind of the operator.

§ II.—*Operative Process.*

The amputation of the arm at the joint, is one of those that offer the greatest variety in the number of the operative processes. Every surgeon, who has performed it, has deemed it his duty to propose one. The circular flap and ovalar methods, and all the different modifications that these general processes admit of, have been used for this amputation.

A. *The Circular Method.*—The idea of applying the circular method to the disarticulation of the arm, does not belong, as M. P. F. Blandin (*Dict. de Méd. et de Chir. Prat.*, t. II., p. 258) supposes, to the author of the article on *Amputation* in the Encyclopedia. De la Roche, (*Encyclop. Méthod. Chirurg.*, t. I., p. 109,) who prepared this article, adopts the flap, and not the circular method; but Garengeot (*Opér. cit.*, p. 460, t. III., 2e edit.; t. II., p. 378, 1e edit.) says positively that, in his time, several persons gave it the preference. Bertrandi (*Opér. de Chir.*, p. 454) also speaks of and censure it. Alanson described it in 1774, and proposes that the muscles should be divided obliquely, as in amputation of the thigh. It is a great error, therefore, for M. Graefe to have supposed that he was the inventor of it, and that other moderns should have claimed this honor; but each one of these authors has presented it under a particular point of view.

I. *Ancient Process, or that of Garengeot.* The passage in Garengeot which refers to the simple circular method, points out, but does not describe, this method. The artery being compressed by an indirect ligature, (une ligature médiate,) [see vol. I.,] and the soft parts raised up by an assistant, an incision is made successively through the integuments and muscles down to the bone, commencing at three fingers' breadth below the acromion; a last cut of the knife detaches the head of the humerus from the glenoid cavity, and completes the operation.

II. *Bertrandi* is evidently more clear. A large convex bistoury divides through the body of the deltoid upon its dorsal surface, at some distance from the acromion, arrives at the biceps muscle, opens the capsule, passes behind the head of the humerus after we have luxated it, and terminates the division of the soft parts with that of the posterior half of the limb; "so that when the arm is separated, there remains a circular incision through the soft parts, around and in front of the glenoid cavity."

III. *M. Cornuau* (*Thèse* No. 71, Paris, 1830) has proposed a process founded on the same principle as the preceding. The skin being divided at four fingers' breadth from the acromion, and drawn

back by an assistant, the operator proceeds to the section of the muscles, which he accomplishes with a single stroke of the knife, carried transversely from the coraco-brachialis muscle down to the tendon of the teres major, causes them to be raised up, opens into the joint, which he traverses from above downwards, grazes the neck of the humerus, and terminates by a second transverse incision, which unites the two extremities of the first, includes the vessels, and makes a circular wound.

IV. *Process of Alanson and M. Graefe.*—Alanson's method has nothing in it peculiar. But M. Graefe, in order to form, at the expense of the muscles, a hollow cone with its base downwards, uses the broad point of a buckler-shaped (*en rondache*) knife.

V. *Process of M. Sanson.*—Adopting the pure circular method, M. Sanson (*Elem. de Pathol.*, etc., t. III., p. 498, 2e edit.) divides at the same stroke both the skin and muscles, at an inch below the acromion and before disarticulating the humerus.

VI. *Process of the Author.*—I have repeated all the modifications of the circular method upon the dead body, and have ascertained that there is no other method more rapid, or forms a more regular wound, or one more easy to unite by the first intention. The process which has seemed to me to combine the most advantages, consists in dissecting and raising up the skin to the extent of two fingers' breadth, and without interfering with the vessels; then to divide the muscles as near as possible to the joint, which is to be immediately laid open; terminating the operation with the division of the triceps, and of the bundle of vessels whose trunk has been previously secured by an assistant.

B. *The Flap Method.*—The different processes included under the flap method, may be divided into two classes. By one, we make a transverse wound; while the others, on the contrary, produce a solution of continuity whose greatest diameter is the vertical.

I. *Transverse Method.*—Each one of these two classes forms, to some extent, a particular method, whose respective advantages and disadvantages should be carefully considered. The first was for a long time the only one employed, and to this belong the processes of Le Dran, Garengcot, De la Faye, and Dupuytren.

a. *Process of Le Dran, (Opérat., p. 571.)*—The patient being seated upon a chair, an assistant seizes the arm and holds it at a short distance from the trunk; with a narrow knife, the surgeon then makes a transverse incision through the deltoid, the two portions of the biceps a little in front of the acromion, the tendons which are attached to the head of the humerus, and the fibrous capsule; while an assistant gives a swinging (*fait basculer*) movement to the arm, and luxates its head from below upwards, the surgeon, holding his knife constantly in a transverse direction, passes the instrument behind and cuts out a flap, of from three to four inches in length, at the expense of the muscles of the posterior part of the limb, in which flap are comprised the plexus of nerves, the vessels, the borders of the axilla, and various muscles.

b. Process of Garengéot.—Garengéot's mode of operating (t. III., p. 457) differs in three particulars from that of Le Dran. In order to compress the artery, he advises, instead of a straight needle, to use one that is curved, which is to be inserted from before backwards through the muscles, and to graze the neck of the humerus. With the view of forming an upper flap at the expense of the deltoid, he recommends the first incision to be made at three fingers' breadth in front of the acromion. Finally, in terminating like Le Dran, with a flap in the axilla, he gives it less length and cuts it in a square shape, in order to adapt it better to the deltoid flap.

c. Process of De la Faye.—La Faye (*Mém. de l'Acad. de Chir.*, t. II.) does not apply any previous ligature. Differing from Garengéot, and coinciding with Le Dran, he recommends but one flap only; but, instead of placing it below, he takes it from above, and gives it the form of a trapezium. A transverse incision is first made, at about four fingers' breadth from the apex of the acromion; two other incisions, one of which is begun upon the inside and the other upon the outside of this process, are continued in a line with the muscular fibres to the extremities of the first. The flap being dissected and raised up, enables us to enter the joint, luxate the humerus, lay bare the soft parts of the axilla, and to apply a ligature upon the artery before detaching the arm from the trunk immediately underneath. In place of a trapezium flap, Portal, (*Précis de Chir.*, t. II., p. 791,) imitating Dahl, (*Amputat. ex Articul.*, etc., 1760,) prefers one which is V-shaped.

d. Process of Dupuytren.—In a thesis supported in 1803, Grosbois recommends the following modification of the process of La Faye: With one hand he seizes the whole thickness of the soft parts which are to form the upper flap; with the other he plunges through these tissues at the base of the deltoid, with a small knife held horizontally, and the cutting edge of which is to be directed forwards; the flap is then cut out from behind forwards and from within outwards, taking care to give it the suitable length. Grosbois speaks of this modification as one that belongs to him, and which he had long reflected upon. It is probable, however, that he derived the idea of it from the lectures of Dupuytren, for it is under the name of this professor that it is generally known.

e. Process of M. V. Onsenort, (Graefe und Walther, *Journal*, t. X., p. 469.)—In place of forming the deltoidal flap by cutting from the soft parts to the skin, it may be done in the opposite direction; that is to say, from the integuments to the articulation and from the apex to the base, giving it also a semilunar form. This mode, too, which does not differ materially from that of Garengéot, is also, by some pupils of medicine, ascribed to Dupuytren. I have seen MM. Dubled and Guersent (the younger) perform it upon the dead body with great rapidity; and M. V. Onsenort, who uses a knife curved on its flat side, endeavored, in 1825, to point out its great advantages. Cline, who commences by compressing the artery upon the first rib, and who makes a flap capable of covering the wound with a narrow knife at the expense of the deltoid,

then divides the articulation, and with a single stroke the muscles which connect the arm to the shoulder and the trunk. This process, which the surgeon of London was in the habit of employing a long time since, and which is adopted also by Chiari, (*Renzi, trad. Ital. de ce Livre*, p. 306,) is described by M. Smith, in the work by Dorsey, (*Elements of Surgery*, vol. II., p. 222,) in an exceedingly obscure manner; it has, however, a good deal of resemblance to the preceding, and I ought to add that, in making trial of it according to the mode indicated, I found that I could perform the operation with almost inconceivable rapidity.

f. Process of Grosbois, attributed to MM. Lisfranc and Champesme.—Grosbois (*Thèse* No. 190, Paris, 1803) had already remarked that another advantage could be obtained from his proposed modification of the process of La Faye, by proceeding in such manner as to open at the same stroke into the upper part of the articular capsule. MM. Lisfranc and Champesme have constructed from this suggestion the basis of a new process, (Coster, *Manuel de Méd. Opér.*, 3e édit., p. 95.) The arm being slightly approximated to the trunk is carried upwards and outwards. The operator being placed in front of the shoulder applies the point of his knife to the coraco-acromial triangle, one of its edges being in a direction upwards and forwards, the other backwards and downwards; he then plunges it through the soft parts and the articulation from within outwards, from before backwards, and from above downwards, so that it may come out an inch behind the acromion; he then with one hand seizes the deltoid and raises it up; divides it from behind forwards and slightly from below upwards; passes round the upper part of the head of the humerus, giving gradually to the blade of the instrument a direction almost horizontal; separates the arm from the trunk as soon as he has proceeded in his incision to the extent of about an inch, and finishes the flap as in the process of Grosbois and Dupuytren.

g. Bell (*Cours de Chirurgie*, traduit par Bosquillon, t. VI.) commences with a circular incision at four inches below the joint; he then makes a longitudinal one upon each side in order to form two flaps in the manner of Ravaton; dissects and raises up these flaps, and finishes by disarticulating.

h. The process of Laroche (*Encyclop. Méthod.*, Part. Chir., t. I., p. 109) differs from the preceding in this, that the circular and lateral incisions being made, the author raises up the anterior flap, and proceeds to the division of the joint before completing the posterior flap.

i. Appreciation.—Of all these modes the most rapid and simple is that of Cline, or of M. Onsenort; but it is difficult then to give to the upper flap all the extent desirable. That of Grosbois which comes next, would be yet more rapid if in performing it, surgeons who are unpractised did not run the risk of striking the point of their knife against the head of the humerus or the acromion. It endangers, moreover, the formation of a flap much too thin at its base. It is evident, however, if we should be satisfied with an

upper flap, that the process of Grosbois or of Dupuytren would be preferable to the three incisions of La Faye.

II. *The Vertical Method*.—To the second class of the flap method belong all those processes whose object is to place the flap in front or behind, or full as well to make one on each side.

a. *Process of Sharp*.—The first process which appears to belong to this series is that of Sharp, (*Opérat. de Chirurg.*, p. 389.) This author first divides the skin, the deltoid and the pectoralis major, from the apex of the acromion to the hollow of the axilla, so as to lay bare the vessels and to be enabled to tie them; he then passes through the articulation from within outwards, and terminates by dividing the soft parts on the opposite side, so as to preserve as much of the integuments as possible.

b. *The Process of Bromfield* is too complicated and too long to be described at present, though it belongs to the vertical method.

c. *Process of Poyet*.—Poyet (*De Method. Amput.*, etc., 31 Août, 1759) in a thesis upon the disarticulation of the arm, proposes to make a longitudinal incision from the apex of the acromion to nearly as far as the deltoidal depression (empreinte) upon the humerus; then to separate the lips of the wound, in order to divide the articular capsule and the tendons which surround it, and to luxate the head of the bone, terminating by passing the knife between this last and the muscles which are divided with a single stroke from above downwards. Dorsey (*Op. cit.*, Vol. II., p. 333) of Philadelphia, was successful with a process nearly the same as that of Garengot.

d. *The Process which Laroche describes* in the Encyclopedia, instead of belonging to the circular method, is no other than that of Bell or Ravaton, modified so that one of its flaps is upon the inside and the other upon the outside.

e. *Process of Desault*.—The limb held between extension and flexion is brought slightly forward; the surgeon embraces with one hand the tissues of the shoulder, and with a narrow knife divides them from above downwards and from before backwards, while grazing the head of the humerus; he forms a first and inner flap from three to four inches in length, which includes the anterior border of the axilla and the vessels and nerves, and which the assistant raises immediately up in order that the operator may divide the joint from before backwards or from within outwards, and terminate by forming a postero-external flap similar to the first.

e. (bis) *Hasselberg* (*Nouv. Procédé pour desarticuler l'Hum.*, 1788) in describing the process of Desault, says that the artery is compressed between the scaleni muscles, and the arm raised to a right angle, and that the knife ought at the very first to divide the articulation, and that this first flap has the form of a triangle. Allan (*Journal Général de Médecine*, t. VIII.) on the contrary represents that Desault formed his upper flap with the deltoid alone. Nevertheless it is certain that Giraud, (*Ibid.*, p. 414,) a pupil of Desault, recommends cutting a lower or axillary flap at first, then to divide the joint from below upwards, and to terminate with the upper flap.

f. Process of M. Larrey.—In operating after the manner of Desault, the artery is divided at the first stroke of the instrument, and this might lead to serious accidents if, from any cause whatever, it should afterwards become impracticable to terminate the operation promptly. M. Larrey has therefore considered that it would be better to commence with the posterior flap, open the joint on its external side, and terminate with the inner flap.

g. Another Process of M. Larrey. M. Larrey, (*Clin. Chir.*, t. III., p. 563,) who has so often performed this operation in the army campaigns, describes another process whose advantages he greatly extols. In the same way as is done by Poyet, he first divides the whole thickness of the stump of the shoulder in the direction of the fibres of the deltoid, and to the extent of four inches. He then separates the two lips of the wound, at the upper extremity of which he re-inserts the knife and plunges it from above downwards, so that it may come out in front of the posterior border of the axilla, and thus form the outer flap. Returning to form in the same manner the anterior flap, and leaving between them all the soft parts which separate the two borders of the axilla, in order to avoid the artery and plexus of nerves, he then divides the deep-seated tendons and the capsule. After having divided the joint, he passes the knife behind the head and surgical neck of the humerus in order to terminate with the section of the *pedicle* (pedicule) which unites the two flaps below, obtaining by this means a wound which is nearly oval.

h. Process of Dupuytren.—In the place of forming the posterior flap by puncture, Dupuytren cuts it from without inwards, that is, from the apex to the base, and in other respects proceeds in the same manner as M. Larrey.

i. Process of M. Delpech.—If we omit to form an outer flap, or give this flap but very little length, and strike almost directly upon the posterior face of the articulation in order to open into and divide it, terminating by cutting a large inner flap, we have the process of Delpech.

j. M. Hello (*Thèse* No. 258, Paris, 1829) after having cut an outer and upper flap like Dupuytren, proposes that we should afterwards pass the knife between the shoulder and the chest, to terminate the operation according to the rules of the circular method. This process adopted, he says, by Foulloy, and which Laisne (*Jour. Gén. de Méd.*, t. VIII., p. 401) compelled by the state of the tissues, had also already employed, is particularly serviceable where the humerus is shattered, and where the displaced bony fragments render the formation of any flap whatever by puncture more difficult than usual. Two sailors thus operated upon in England about the beginning of the present century, were cured on the twentieth day.

k. Process of M. Lisfranc.—M. Lisfranc, in order to avoid the objections made to the process of Grosbois, and at the same time to retain its advantages, causes the arm to be held a short distance from the trunk, places himself outside of it, applying the point of a

long knife in front of the posterior border of the axilla as if to raise up this border, divides the whole thickness of the muscles and the articulation itself from below upwards and from behind forwards, and brings the instrument out between the anterior border of the acromion and the coracoid process, raises the arm a little and inclines it slightly backwards, passes around the upper and posterior half of the head of the humerus with the blade of the instrument, cutting in this manner his posterior flap, and then returning to the joint and finishing like Dupuytren or Delpech.

C. *The Ovalar Method*.—Correctly interpreted, the origin of the ovalar method might readily be discovered in the processes of Poyet, Sharp, Bromfield (*Observ. & Cases, etc., 1773*) or M. Larrey. It is nevertheless true, that it belongs neither to Béclard, to whom it is attributed in France, nor to M. Guthrie who was the first to describe it in England. I find it very accurately described in many theses of the school of Strasbourg, and especially in that of A. Blandin supported in 1803, and still more clearly in that of Chasley, who had already employed the term *ovalar* to designate the form of the wound. The several processes which it presents scarcely differ from each other.

I. *Process of M. Guthrie*.—In the process of M. Guthrie, the two incisions which should describe a kind of V, and which are made to set out from the apex of the acromion, to descend obliquely, the one in front, the other behind, down to the lower extremity of the corresponding border of the axilla, comprise at first no more than the common integuments. The muscles are afterwards divided in the same direction and a little higher up, that is to say, on a line with the retracted skin.

II. *Process of Béclard or Dupuytren*.—On the contrary, when we wish to imitate Béclard or Dupuytren, we go immediately down to the bone; but in both cases each side of the wound should be slightly convex in front and sufficiently superficial in its termination to avoid running any risk of wounding the vessels. The apex of the flap is detached and reversed downwards by a third stroke of the knife before proceeding to open into the articulation; in fact the base of the V remains untouched to the end of the operation, and is not detached until after having disarticulated the bone and grazed the posterior surface of its upper fourth.

III. *Process of M. Scoutetten*.—M. Scoutetten after having, like Sharp, brought the inner incision from above downwards, as far as the outward border of the axilla, while passing around on the axillary side of the arm, resumes it on the outside to prolong it from below upwards, with the precaution, carefully kept in mind, to divide only the skin under the root of the limb, and not to touch the vessels.

IV. *Process adopted by the Author*.—*a.—First Stage*.—When the muscular fibres are divided very near their origin, their retraction must be inconsiderable; it is therefore advantageous, when the patient has the shoulder abundantly supplied with muscular tissues, to follow M. Guthrie, and divide the skin and cause it to retract before

proceeding farther. In an opposite state of things this precaution is unnecessary; the integuments and the muscles may then be divided with the same stroke of the knife.

b. Second Stage.—The delicate point in the oval method, is the opening into the capsule. If the bistoury goes too deeply the fibrous pouch recedes, becomes folded on itself like a piece of wet linen, and is rather masked than cut. If it should strike within (*en-deça*) the anatomical neck of the humerus, the ligamentous adhesions will be but imperfectly destroyed, and the difficulties will appear still greater. To obviate this embarrassment, we should, after the lips of the wound are separated by the assistant and drawn back towards the shoulder, seize the arm with one hand, make the head of the bone project, turn it upon its axis from without inwards, introduce flat-wise a very finely sharpened bistoury between it and the tissues, place this bistoury afterwards at a right angle upon the capsule, on a line with or a little beyond the anatomical neck of the bone, and divide then upon its full edge, and *perpendicularly* all the tendons, commencing with the *teres minor* and finishing with the *sub-scapularis*, and while taking care to let nothing escape, use the head of the humerus as a point d'appui to make it roll upon its axis from within outwards, in proportion as the instrument proceeds from behind forwards, or from without inwards. By this means we open freely into the articulation, and can luxate the arm with ease; which enables us to make tension upon the parts of the capsule remaining, and which we at length completely detach by directing the bistoury forwards, backwards and then inwards, as if for the purpose of grazing (*raser*) the bone.

c. In the third stage the assistant, placed outside the shoulder, glides his thumb upon the artery in front of the glenoid cavity, compresses this vessel in the species of pedicle which unites the lower extremity of the two first incisions, while with a small knife or the same bistoury he has been using from the beginning, the surgeon makes the section of the base of the primitive V, and completes the separation of the limb from the trunk.

V. When we wish the *two incisions* to set out from the *acromion*, we should make use alternately of the right and the left hand; but should we not be *ambidexter*, it is very easy to make the second incision from below upwards, so as to unite it with the first. A good bistoury, rather convex than straight, answers for every stage of the operation. Some persons, however, prefer a small amputating knife; and there are others who commence with the first and finish with the second of these instruments.

§ III.—*Comparison of the different Methods.*

In all the processes which have passed under consideration, to whatever method they may belong, the temporary suspension of the course of the blood must be attended to. The indirect ligature of *Ledran* and *Garengéot* is not to be trusted, and besides forms of itself an operation sufficiently grave. *Ledran*

had already remarked (*Opér.*, p. 571) that it could be dispensed with. If, like La Faye, Paroisse, (*Opusc. de Chir.*, p. 208,) and some others, we apply a thread around the artery before completing the lower flap, we rarely fail to include in it parts that ought to have been avoided. We cannot imitate Sharp and Bromfield without increasing the sufferings of the patient and protracting the duration of the operation. Compression, on the first rib, as recommended by Camper, whether by the thumb or with a hand-pelote, (pelote à manche,) or should we resort to the tourniquet of Dahl, applied upon the second rib in front of the clavicle, a kind of compression which Paul of Egina (Portal, *Anat. Méd.*, t. II., p. 232) had already pointed out to arrest the blood, they exact conditions which do not always exist, and would, if badly executed, expose the patient to the risk of perishing by hemorrhage under the hands of the operator. But we have it in our power, by doing as most of the moderns do, to prevent this accident by a plan far more secure and simple. For this purpose it is sufficient, as we have seen, to leave uncompleted the section of the flap which includes the vessels, until after having divided the articulation. The previous and direct ligature upon the subclavian artery which was still made use of in 1821 by M. A. H. Stevens, (S. Cooper, American Edition of his *Elements of Surgery*, 1822,) would not become necessary except in the event of extensive derangement (*déformation*) of the parts.

In fact while the knife is passing from above downwards upon the posterior surface of the disarticulated humerus, the assistant placed behind, embraces the base of this flap in order to compress it between his thumb which rests upon the bundle of vessels, and the other fingers which act as a point d'appui upon the skin of the axilla. In place of using one hand only, there would be no objection to our employing two, if the thickness and width of the soft parts preserved seemed to render it requisite. By this mode of compression which is available for any one, it is evident that we may complete the operation without any apprehensions, and that the ligature upon the vessels afterwards requires no special directions. Without knowing who first gave this rule, Poyet, in his Thesis, supported in 1759, states that he followed it. Bertrandi (*Opérat. de Chir.*, p. 456) also distinctly mentions it, but without designating its author. Others attribute it to Ledran (*Ib.*, p. 571) himself, who in fact describes it in 1742, but in an imperfect manner. However this may be, it is hardly over twenty years, and since the recommendations of Deschamps, (Allan, *Jour. de Sidillot*, t. VIII.,) M. Larrey (*Clin. Chir.*, t. III,) and M. Richerand, that it has become generally adopted. The other arteries which it is also sometimes advisable to tie, are the acromial, the external thoracic and circumflex arteries, and the common scapula. We do not generally attend to them until after having secured the trunk of the axillary artery. If they should bleed too freely, or any circumstance compel us to protract the operation, each one of them may be tied as the knife divides them. As to omitting the ligature and depending upon the elbow (*coude*) of the lower flap to stop the hemorrhage,

all the surgeons of the present day, say with Decourcelles (*Manuel des Opérat.*, p. 391,) that we cannot trust ourselves to this.

Out of so many processes, there is no one which merits an exclusive preference, nor any one which may not effect the object we have in view. That of Le Dran is the best where the soft parts of the hollow of the axilla have alone preserved their normal condition. When, on the contrary, none of these tissues are healthy except at the stump of the shoulder, we are then compelled to have recourse to that of La Faye, as modified. If the disease should have extended farther upon each side than from above downwards, the process of Garengeot or Cline would be applicable. The circular method would become necessary where the skin had undergone degeneration around the whole limb, and as high up nearly as the articulation, and might be replaced by the ovalar method, if it should appear possible to save a little more of the tissues behind than in front. If the alteration has proceeded farther up on the outside than upon the inside, the process of Delpech would have its value. It would be the same with that of Sharp and Desault, or better still, with that of Laisne or M. Hello in the contrary case, provided the artery in the beginning has been avoided by the instrument, and, as has been said above, protected afterwards during the remainder of the operation. Finally, when the tissues are not more diseased on one side than on the other, but are more so in front or behind, it is advantageous to place the flaps vertically, and to give to each of them nearly the same length. We may then choose between the processes of M. Larrey, Bécord, and M. Lisfranc. The mobility or immobility of the limb, the position in which it is found fixed by the disease, and the relations of the head of the humerus with the glenoid cavity, and the processes of the scapula, often also make one process preferable to another. But it is at the bedside that the skilful surgeon may or can appreciate these several indications. In a patient in whom the whole of the arm was occupied by a cancerous affection, I was obliged to employ the ovalar process reversed. The patient, nevertheless, got well.

Now, supposing that there is nothing in the state of the parts which compels us to adopt one process in preference to another, which is the method that offers the most advantages? In the transverse method, there exists between the acromion and the lower border of the glenoid cavity, an excavation too deep and wide to enable us in approximating the base of the flaps, to fill it up completely, for the purpose of promoting easy union by the first intention. We should then unquestionably adopt such processes as procure a vertical cicatrix. The rapidity of that to which M. Lisfranc gives the preference, leaves nothing to desire. The process of Desault, reversed as it is by the modification of M. Larrey and Dupuytren, does not require a much greater length of time. The ovalar process, however, as it procures a wound infinitely more regular, though it exacts more address and more accurate anatomical knowledge, is, in my opinion, still preferable. By practice it

ultimately becomes easy, and I have seen M. Chaumet, of Bordeaux, finish it in thirty seconds upon the dead body. I am not aware of any other than the circular method by the process of M. Cornuau, or that of my own, which are preferable to it, or can be substituted for it with advantage. All these variations in the operation, however, are of such trivial importance in practice, that it would be puerile to dwell upon them at the present day. The process of M. Manec and M. Lesseré, (*Thèse* No. 57, Paris, 1831,) who recommended removing at the same time with the arm, one the acromion, the other the acromion-glenoid cavity and extremity of the clavicle, cannot be applicable unless the bones of the shoulder be actually diseased.

I have already remarked that the disarticulation of the shoulder is an extreme measure, and that we ought to reject the advice of those who, like La Faye, recommend that it should be performed even in cases where it might be dispensed with by applying the saw below the head of the humerus. It does not follow, nevertheless, formidable as it was first thought to be, that it is much more dangerous than amputation in the continuity. "We have so often performed, and seen performed successfully, extirpation of the arm," says M. Gouraud, "that we doubt if it is scarcely more dangerous than amputations between the articulations, and it is questionable, in fact, if in wounds from fire-arms it is not preferable to it." M. Bancel, in his Thesis, cites sixty successful cases. M. Larrey avers that he has found it succeed in ninety cases out of a hundred. Sabatier speaks in admiration of the success this surgeon had in fourteen cases out of seventeen; and Percy allows that out of seventy persons thus amputated, we lose only a sixth part. Immediate union is specially applicable to it, and for the subsequent treatment, the same precautions pointed out under amputations and operations in general are specially required, whether in relation to the dressings or the regimen, or to prevent visceral inflammations, moderate the general reaction, and protect ourselves against the consequences which too often result from capital operations.

ARTICLE VIII.—AMPUTATION OF THE SHOULDER.

§ I.—*Indications.*

After amputation of the arm at the joint, it would seem that we could advance no farther upon the root of the limb for the purpose of its removal. Nevertheless, if the disease should have invaded a part of the shoulder as well as the arm; if the clavicle, acromion, coracoid process, and even the head of the scapula, should have all become implicated in the disorganization, what should the surgeon do? Should he remain a passive spectator of the progress of a fatal disease? The Samuel Wood mentioned by Cheselden, and the three other patients whose history is given by Carmichael, Dorsey and Mussey, (*Gaz. Méd. de Paris*, 1838, p. 394,) had the

shoulder entirely torn off, and nevertheless got well! M. Larrey, (Carteron, *Bulletin de la Fac. de Méd.*, t. IV., p. 218,) in his campaigns, has frequently been obliged to remove with the arm a large portion of the scapula or clavicle, and more than on one occasion has success rewarded his courage. After having disarticulated the arm, M. Clot believed it to be necessary to remove also the neck of the scapula, and his patient recovered, (*Lancette Française*, t. IV., p. 84.) In 1808, moreover, M. Cuming, (*Bull. de Férussac*, t. XXII., p. 91,) at the Hospital of Antigua, [Antigua?] removed the whole of the shoulder, with the arm, in a patient who recovered perfectly. Since then, M. Brice, in the year 1827, was equally fortunate with M. Clot, in removing a portion of the clavicle and scapula at the same time with the arm, in a Greek soldier with a gun-shot wound. Amputation of the shoulder may also become necessary in order to save the arm. Janson has given an example of this kind. I find a second case in the thesis of M. Piedagnel (*Thèse* No. 250, Paris, 1827) which belongs to Beauchêne. A third belongs to M. Lucke, (*Bull. de Fér.*, t. XXII., p. 89,) who performed the operation in 1828, as will be mentioned elsewhere. Bonfils and M. Gensoul (*Journal des Hôpitaux de Lyon*, p. 97–100) have each removed the shoulder for a cancerous tumor, once, and M. Syme (*Edinb. Med. and Surg. Journ.*, October, 1836) had a case which recovered after he had removed the acromion, glenoid cavity, and corresponding portion of the clavicle, as M. Hunt (*American Med. Recorder*, Vol. I., 1818) had already done in a patient forty-six years of age, who had already undergone amputation of the hand, and afterwards disarticulation of the arm for the same disease. M. Mussey also (*Gaz. Méd. de Paris*, 1838, p. 394) was obliged in one case to extirpate the entire shoulder, and the patient recovered. (See *Exsection of the Shoulder*, farther on.)

This amputation is sometimes required in cases of necrosis, caries, and comminuted fracture, with more or less extensive disorganization of the soft parts, because simple disarticulation of the arm would not allow of our removing the whole disease. At other times, it is required for some degeneration, or for a tumor composed of abnormal tissues, and which includes a part of the arm, and extends beyond the joint. Again, the tumor and morbid degeneration may involve only the scapula and the tissues that surround it; in such cases we may preserve the arm.

§ II.—Operative Process.

A. *First Case*.—We lay bare the diseased bones until we come to the sound parts; the flaps, formed and managed as in amputation of the joint, are also cut out in this or that manner, according to the state of the tissues, and then reversed and held by assistants; if it should appear impossible to avoid the artery, we then make pressure upon it on the first rib, should it not seem more advisable to apply the ligature to it at the outset. If it should become necessary to remove the three projections which terminate the

scapula in front, the saw should be applied behind the root of the coracoid process, or on the outer side of the spine of the scapula, in order to remove the whole at a single cut. When only one of them is diseased, either the acromion, the glenoid cavity or the coracoid process, it is better to saw from without inwards, or from behind forwards; whilst the outer extremity of the clavicle requires that we should saw from before backwards, or from above downwards. It is unnecessary to remark, that in order to accomplish these different kinds of sections in a proper manner, we should make use of a saw similar to that generally used for the section of small bones, or the chain saw of Jeffray. Upon the supposition that there are only some splinters or fragments of bone which may easily be removed from above the joint, we must confine ourselves to extracting these, and to the processes for disarticulation of the arm.

B. Second Case.—As the form, size, and precise seat of the tumor in these cases can have no fixed relations, it is, for the same reason, difficult to trace out the rules for such an operation. It is, by falling back on his intimate knowledge of the parts, and the resources of his own mind, that the surgeon will be enabled to determine the precepts which should then guide him. In the year 1825, there were received at the Hospital of Perfectionnement, at the same time, two men, having enormous colloid (colloïdes) tumors upon the shoulder. One died without being operated upon, and the examination, after death, showed that the two upper thirds of the humerus, and the greater part of the tissues that envelope it, together with the anterior half of the bones of the shoulder, were replaced by a lobulated, whitish mass, as friable as the texture of an apple or a green pear. M. Roux, with a desire to save the other, operated upon him Dec. 6, in presence of M. Marjolin, and a great number of students. The tumor which had existed four years, occupied the right arm, was double the size of the head of an adult, and of an ovate form with the point descending nearly down to the elbow, and its base prolonged as high up as to the root of the acromion. The patient was 54 years of age, strong, of good constitution, and in full vigor, and there was no indication that any of the viscera were affected.

The first flap was circumscribed by a semilunar incision, with its convexity in front, and extending from the middle of the spine of the scapula to below the anterior border of the axilla; two branches of the acromial artery being opened, they bled freely, and I compressed them with the fingers. A second flap, corresponding in its base to the infra-spinous fossa, and of the same form as the preceding, was then cut upon the outside and behind; a branch of the common scapular artery of considerable size being divided, it was immediately stopped by the finger. It was deemed proper to exsect the acromion in order to continue the dissection of the diseased mass with greater facility; threads were applied upon various small arteries, and the incisions continued down to the clavicle and glenoid cavity. These two portions of bone were immedi-

ately removed by the saw. After a protracted search, the axillary artery was at last found. The tumor now was held only by a loose pedicle, which included the vessels, and which I seized with my two hands in order to enable M. Roux to complete the removal of the limb without danger. Finally, the operator returning in search of the remains of the tumor, removed also with his saw the coracoid process, and the anterior fourth of the scapula.

Although the patient did not lose more than twelve ounces of blood, he became pale and seemed greatly prostrated. During the day he remained very comfortable, but the night passed without sleep. On the 7th, in the morning, the pulse continued small, the chest constricted, and a cold sweat was remarked upon his face, which retained its paleness; but there was no actual suffering. This state of exhaustion gradually increasing, death supervened on the 9th, at 7 in the morning, without being preceded by delirium or any commotion, (agitation.)

The necropsy exhibited nothing which could explain this result, which was as fatal as it was rapid. The tumor weighed twelve pounds; a plaster cast of it was carefully taken, which should be found in the museum of the Faculty, where I deposited it.

This kind of tumor, moreover, is very common. It gives to the limb a shoulder-of-mutton (gigot) form. Pelletan has noticed it, and Hey has given a plate of one. The tumor in the patient of M. Gensoul, and also of that of M. Syme, was similar to this. I have seen three other cases, and I could easily enumerate here twenty examples of the same kind. In the haunch I have seen two cases of it: one, a Polish officer, who went to Bordeaux, and died there; and the other, a young man who died at La Charité; in this last the tumor weighed over thirty pounds. A patient, in whom I removed the arm, with the acromion also, had this tumor. Belonging, as they do, to the class of encephaloidal tumors, the tissue which composes them is reproduced (repullule) with a frightful rapidity.

C. *Third Case*.—So also where the scapula alone and its dependencies are affected, a definite rule for proceeding is wanting; for sometimes the tumor is wholly on the outside of this bone, sometimes on the inside, while in other cases it projects from both its two surfaces, comprising to a greater or less degree its whole substance. On the other hand, it is evident that the disease, in place of a morbid, external growth, may consist of an extensive degeneration of the bones. (See Exsection of the Shoulder, *infra*.)

[DISARTICULATION OF THE SCAPULA AND ARM TOGETHER.—AVULSION.]

The possible DISARTICULATION OF THE SCAPULA,—if such a phrase is allowable,—becomes a matter worthy of consideration from the new facts, of late years, upon the subject of limbs torn from the body.

The subject of AVULSION of the Limbs, at the articulations,

generally caused by persons getting entangled, or suddenly drawn into portions of machinery, in manufactories, going with great rapidity, is one that has, within a few years, attracted considerable attention, while the recoveries from such frightful lacerations have led to some curious and, as it seems to us, important pathological results for surgery. One of the most recent and terrific cases on record, which *recovered*, is related by A. King, M.D., of Glasgow, (*Cormack's London & Edinburgh Monthly Journal of Med. Science*, Feb. 1845, p. 96, &c.) The patient, a stout boy, æt. 15, had his *whole left arm, with the scapula entire, torn off*, by his hand being caught in the wheels of a grain-mill, Oct. 10, 1843, leaving a jagged, irregular, and ghastly wound, commencing an inch from the sternal extremity of the left clavicle, and coursing along the under third of the neck, thence downwards, forwards, and backwards, terminating at the fourth false rib anteriorly and laterally, and three inches on the *right side* of the upper portion of the dorsal division of the vertebral column posteriorly. The loss of integument was chiefly behind and below the situation of the left clavicle. The *muscles* on the front and side of the *chest*, with the *exception of a very few fibres*, were removed, *exposing the intercostals*; they had been dragged from their thoracic attachments, leaving the skin loose and puckered, as if too ample for the subjacent textures. *No fragment of the scapula* could be discovered in its situation. The clavicle was drawn downwards and forwards, but maintained its connection with the sternum. The *axillary artery* projected from beneath the displaced clavicle, to the *extent of two inches and a half*, and pulsated strongly to within an inch of its orifice, but gave exit to no blood. On a minute examination of the torn orifices, the *external coat* of the vessel was found to be divided into three irregular pieces, which encircled each other and held in their embrace a *small coagulum of blood*. There was *no venous hæmorrhage*, and *no large venous trunk discovered*. The nerves were torn at irregular distances, varying from three to five inches from the surface of the wound; their extremities were *greatly attenuated*, and the *slightest* irritation upon them gave rise to the most acute suffering. The artery was secured by a ligature, being deemed, as it certainly was, the most prudent course, for it would hardly have been otherwise than an act of unwarrantable temerity to have looked for its cicatrization after the *torsion* which had been effected or forced upon it, by the violence of the accident. About two inches of the projecting portion of the clavicle was *sawn off*, and the integuments were drawn together by adhesive plaster, which was made to cover without any stretching, the vessels, nerves, and indeed the whole wounded surface, with the exception of a small, irregular portion near the spine, about three inches in circumference. The patient did not even swoon, but was found *standing by the wheels*, which had been promptly stopped; and not until his tattered clothes, adhering with his torn-off shoulder and arm to the machinery, were being removed, did he evince even pain, and then complained but little. Not two cups of blood, in all,

were found on the floor, and on the arrival of the surgeon, half an hour after the accident, not a drop of blood oozed from the frightful wound! Nor was there any hemorrhage afterwards. The reaction was trifling, and appeared to be only what was required by nature to restore tone to the system from so violent a concussion. The pulse continued for several weeks steadily at, or a little over, 130 in a minute, and soft and of moderate strength—the tongue clean, skin cool, and appetite good, and patient lively. The continued celerity of the pulse, in fact, might, as we think, be readily accounted for by so great a destruction and sudden ablation of parts, without hemorrhage, which thus accumulated or concentrated just in the same proportion to this loss of substance the nutritive powers left in the circulation, and therefore the quantity of blood in the whole system; requiring consequently its more rapid passage through the heart and lungs. On the tenth day several portions of the integuments which had been brought over the face of the nerves, and some of the ragged margins of the wound had separated by sloughing; but healthy granulations were springing up on all sides. The plexus of nerves, which had become exposed to the extent of three inches, lay together in a mass, and were partly sphacelous; but when touched by the dressings, or otherwise, the boy manifested a degree of terror, says the surgeon, I have seldom seen equalled, and declared he would sooner perish than allow any interference. The ligature lay in contact with the nervous mass, and in consequence of the extreme sensibility of the part, was allowed to drop off with the sphacelated nerves, *about the middle of the sixth week*, after the boy had been walking about *for some days in perfect health*. A dissection of the torn-off limb and scapula exhibited a fracture midway on the humerus,—the integuments on the outside of the head of the humerus entire, but on the inner and anterior surface of the bone, completely removed, and the nerves and blood-vessels exposed,—the nerves torn and separated into small bundles like pieces of cord, some $5\frac{1}{2}$ inches long, and the shortest one inch from the shoulder joint,—the artery (the *brachial*) torn directly across, about two inches on the distal side of the shoulder-joint, and looking as if severed by a cutting instrument,—the internal and middle coats, on being laid open, presenting the appearance of being slightly retracted and puckered,—the acromion and coracoid processes of the scapula entire, but the *other portions* of the bone (scapula) so mutilated and crushed to minute fragments, with the surrounding muscles, that they could not be distinguished from each other.

Dr. King draws attention to the leading feature of the absence of hemorrhage, and the trifling shock on the system produced by so immense and lacerated a wound, unaccompanied, it may be said, even with syncope, and at no time stupor or fever, strictly so called. Such slight morbid effects from such terrible violence, which have been frequently noticed also in similar cases, lead to the supposition that, could disarticulation, thus almost instantaneously accomplished by a natural application of mechanic force, rapid and as it were

spontaneous, while the patient has scarcely time to be conscious of the operation, be thus performed intentionally and by art, and limbs thus quickly wrung or twisted off from their joints, there would be less to be apprehended from consecutive symptoms, than after the most dexterous application of surgical instruments. The general arguments, also, advanced of late years with so much earnestness by Amussat and others, in favor of *torsion* of arteries (see vol. I. of this present Amer. ed. of Velpeau; also this vol. II.) in preference to ligatures, seem to acquire great weight from details like those of the above remarkable, not to say almost marvellous and incredible, case; for herein *torsion* was certainly exercised on a vast extent of surface and upon a gigantic scale as to the great trunks interested. In truth, the first ideas of torsion as a surgical expedient unquestionably came from the almost total absence of hemorrhage in such wounds, and which dissection, as is seen in this case, proved to have been effected by the same breaking and rolling up of the two inner coats and the resistance and preserved integrity of the outer elastic coat, which are shown to be the results where arteries are submitted to torsion by a surgical instrument. Dr. King finds but a very few cases of avulsion on record. Belchier, (*Philosophical Transactions*, vol. XI., p. 313,) relating the case of the man who had the arm and shoulder-blade torn off by a mill, says he was not sensible of any pain, but only a tingling about the wound; and actually did not know his limb was torn off, till he saw it in the wheel! and soon recovering from his pain, or rather fright at this loss, came down a narrow ladder to the first floor of the mill! The boy described by Mr. Carter, (*Medical Facts*, vol. II., p. 18,) whose left leg and thigh and part of the scrotum were torn off by a slitting-mill, was found by the surgeon lying on the floor under a blanket, seemingly free from pain, and only anxious because his parents would be in such trouble! The same in the boy aged nine, whose leg M. Benomont (*Hist. de l'Acad. de Chir.*, t. II., p. 79) states was torn off at the knee by the wheel of a carriage, but whose only trouble was an anticipated reprimand from his parents. The girl aged eleven years, described by Dr. Clough, (*Memoirs of the Medical Society of London*, vol. III., p. 519,) had strength to walk across the court, from the coach to the hospital, shortly after her humerus had been torn from the scapula in a mill. Two other cases (*Traité Complet des Accouchem.*, par M. De la Motte, Obs. CCCXLI.; see also Dr. Cooper's case, *New York Jour. of Medicine*, vol. I., p. 284) are too imperfectly given to allow of more than merely this reference to them. In one case only, that of a child as related by M. Carmichael, (*Medical Commentaries*, vol. V., p. 80,) the avulsion of the left arm by a mill, though the patient recovered a little and spoke, was soon followed, but without any loss of blood, by cold extremities, low tremulous pulse, and convulsions over the whole right side of the body and face.

In one case only, also, of the above was there profuse hemorrhage: viz., in that of Belchier, (*Loc. cit.*, p. 314; also *Cheselden's Anatomy*, p. 321.)

Dr. Jones (*Jones on Hemorrhage*, p. 42, cap. XII.) has clearly shown, in his valuable experiments, that in these lacerations, which is seen also, says Dr. King, in the natural instinctive act of brute animals in bruising the umbilical cord, nature providentially guards against the loss of blood. The brittle, internal coats of the vessels give way, and their retracted *debris* fill up the outer, firmer, elastic coat, and this plugging up of the vessel, (See *Costello's Encyclop.*, part V., art. *Avulsion*,) and also the now elongated *conical* narrow orifice of the external coat, all resisting the force of the circulation, naturally favor the deposition of coagulum lymph, and consequently, cicatrization. These are now the most approved views, and more recent observations have shown that the important part in this process is rather in the mechanical breaking, rolling, and pushing up of the two inner coats, (as in torsion,) than in the deposition of lymph, as Dr. Jones imagined. [See notes *supra*, under arteries, &c.]

In the case of Dr. King, he justly remarks, as we think, that the lacerated fragments of the nerves exposed should have been immediately removed by the knife, which would have greatly diminished the present suffering, and danger of neuralgia afterwards. So should lacerated and contused portions of cellular tissue and fibre be removed by the knife to avoid sloughing and suppuration; but in this case there were no such parts, as the whole mass appears to have been whipped off, smack and smooth, down to the ribs!

It is true, as Dr. King says, that we see only the favorable side probably of most such cases, to wit, the fortunate ones, while the fatal results are hushed up. But it must be confessed that their phenomena, viewed in any light, are pregnant with important reflections, and lead, as in this case of Dr. King especially, to the conclusion almost irresistible, that the *entire scapula* and its *muscles* in front and much of those behind, together with the arm and a section also of the clavicle may be removed from the body and be followed notwithstanding by a perfect restoration of health. It is difficult to conceive how such a terrible and extensive destruction of soft parts, muscular tissues, vessels and nerves, and exposure of aponeurotic, cartilaginous and synovial surfaces and sheaths could have so resulted, and with scarcely any constitutional disturbance. It would seem to give a less formidable aspect to lacerated wounds than that in which they are usually regarded; though there is no question scarcely in our mind that a smooth incision or separation with the knife, could it have been made in the proper directions and at the proper places of division, as in those which nature herself for example had selected in this violent disruption, the result would have been attended with less danger of a fatal issue and better prospects of cure. The natural and best line of division of the parts, however, for the most perfect torsion of the vessels, is doubtless the one here rudely adopted in such accidents. And the question therefore comes back to this, how far nature in such violence is to be imitated by surgical art in attempting, in cases that may offer, such scapular disarticulations as the foregoing, and whether these are not to be considered valuable lessons in pointing

out to us the path by no means yet wholly explored, where (as in anaplastic operations) unachieved triumphs that we can scarcely anticipate are still in store for surgery, so far as enormous destructions, ablation and restitution of parts are possible without loss of life.

Some consideration is undoubtedly to be attached to the extreme and almost instantaneous rapidity with which such ablations are effected. This unquestionably has great and favorable influence upon the results, and it is to be received in some sort as an argument in favor of the once highly lauded but now universally reprobated achievement, which most surgeons plumed themselves upon, of completing the most bloody operations within a limited number of seconds.

We notice some remarks on the above important case of Dr. King, made at a meeting of the Medico-Chirurgical Society of Edinburgh, Jan. 22, 1845, (*Cormack's Jour.*, *ib.*) Dr. Watson on that occasion justly doubted that the slight hemorrhage in such cases depended on the formation of a *clot*, as it required according to his experiments *seven days* to form in a deligated artery. It was well observed by Dr. Douglass MacLagan that the art of *avulsion* was in the highest degree favorable to the interruption of the course of the blood, as he had proved many years since by experiments on the dead human subject and in living animals, in association with Prof. Turner. In dragging out arteries forcibly, until they gave way, the same result was produced, viz., the *cone-like prolongation of the tube*, and the shaping of it into the form of a *pencil, pointed for writing*. The prolonged outer coat formed the apex of the cone; the inner coat was retracted within and projecting into the canal. This strengthens greatly the now received opinion that the actual plugging up of the artery by this species of *membranous tamponing*, has in fact, as seen in torsion, much more to do with the arrestation of the blood than has the formation or deposit of a clot of lymph. The clot alone, however, may be the *tampon*, as it would appear by the late interesting experiments of M. Amussat, (see our note on these, *supra*,) which plugs up the cut extremities of an artery, causing thereby a spontaneous cessation of the hemorrhage. It is also a matter for reflection how far avulsion is to be copied in using torsion on arteries. It would seem reasonable to suppose that torsion, so far as it respects the continued twisting or *revolving* of the artery round upon its long axis, by means of the forceps used, is too much insisted upon, and might injure and rupture in various places the important outer tunic; and consequently that the first step in the process, viz., that of endeavoring to break up the two inner coats and to push them towards the cardiac side, is the point to be most attended to; or that this last in fact is less important than the simple act of *elongating* the artery by the forceps in the left hand, inasmuch as it would appear that this elongation itself, with little or no torsion, suffices to rupture the inner coats and to bring the outer elastic tunic like a *hood or cap* well over them as the inner ones retract. This it

might naturally be supposed it would do from the elastic external tunic submitting so readily to this traction, while the middle tunic, by the natural contractile action of its fibres and the brittleness of the inner coat, seem more disposed to recede or retract within the outer coat. In the living body, however, this elongating traction must necessarily be exercised with caution, inasmuch as a rupture of the trunk high up within the tissues might be attended with serious consequences.

Actual Amputation of Scapula, &c.—In proof of the practicability of removing the scapula, as we have said in our remarks on the extraordinary case of Dr. King above, the *entire scapula*, together with the *external extremity of the clavicle*, have been subsequently amputated with complete success by Professor Rigaud of Strasbourg (*Séance of the Acad. of Sciences of Paris*, July 15, 1844.—*Gaz. Méd. de Paris*, Tom. XII., 1844, p. 469) in an old soldier aged 51, for an osseous tumor which formed on the anterior angle of the left scapula; but it was only the scapula itself with its clavicular attachment which were removed, and not until at the expiration of eight months after the Professor had previously taken off the arm of the same side at the scapulo-humeral articulation for a tumor on its upper portion. M. Rigaud sent casts of the parts to the Academy at Paris. T.]

CHAPTER II.

THE LOWER EXTREMITY, (Membre Abdominal.)

Amputations in general are more difficult and serious in the lower than in the upper extremities. They are performed also on the foot, leg, and thigh, and in the continuity as well as contiguity.

ARTICLE I.—AMPUTATION OF EACH TOE.

The case is not the same with the toes as with the fingers. The uses of the latter render their preservation important, and their length allows of their partial amputation. The toes on the contrary, serving only for standing upon, and having but little extent, may be entirely removed without essentially impairing the functions of the foot. Nor do we scarcely ever amputate for one or two phalanges of the toes, or in the continuity of the metatarsal phalanx. Of these the first toe alone might form an exception to the rule, upon the supposition that its last (unguéal) phalanx was affected in such manner as to allow of our saving a sufficiency of the soft parts to form a suitable flap.

A. *The Great Toe.*—The first toe seems to be an exception to the

general rule, under another point of view. From the time of Le Dran (*Opérat.*, p. 569—*Observ.*, t. II., p. 369) to the present day, most surgeons have preferred dividing the metatarsal bone behind its head, rather than restrict themselves to separating the great toe from it. In disarticulating this toe, we create, it is asserted, a disgusting deformity; the anterior extremity of the bone forms a considerable projection, which is difficult to cover, is liable to painful friction against the shoes, and must in fact only interfere with instead of assisting in the functions of the foot. It is certain that the deformity is less observable after the amputation of the first metatarsal bone than after the removal of the toe only; but it is also undeniable that the power of standing (*la station*) is much more difficult and less secure in the first case than in the second; that this bony prominence which we desire to get rid of, is of the greatest utility, that it hinders the foot from turning inwards and gives a firmer basis to the support of the frame, (*rend plus solide la base de sustentation*.) Under this point of view then, amputation of the great toe alone ought to have the preference.

I have disarticulated the first toe both by the flap and the ovalar method. If the disease occupies the phalangeal articulation only, I make a circular incision behind it, and divide the first phalanx in its continuity, either with the cutting forceps or Liston's nippers.

In making flaps upon the sides in disarticulating this toe, it is necessary to give them a considerable degree of length, and it seldom happens that we are not interfered with underneath by the sessamoid bones. The ovalar method taking all things into view, is the preferable one; but in performing it the surgeon should take care not to go too far behind on the plantar surface of the foot. The sessamoid bones, prolonged as they are under the head of the metatarsal bone, would give him considerable annoyance, if he did not take the precaution to immediately bring back the bistoury in front under the border of the phalanx.

B. *The Little Toes*.—If it should happen that one of these toes was affected only at its extremity, there would be two reasons to justify amputation as far from the metatarsus as possible; 1, the obligation to remove nothing which gives support to the body; 2, the advantage of avoiding the sheath of the flexor tendons. In a boy, aged nine years, I removed in this manner the last phalanx for an exostosis accompanied with fungous ulceration of the ungual surface of the third toe. In another case I removed that of the second toe, and in a third, that of the first. The operation presented no difficulty in any of them, and in the first the wound healed perfectly by first intention. No other scarcely but the flap method from the dorsum to the plantar surface can be applicable in such cases. The pulp of the toe furnishes a cushion which can be readily raised up and which closes the wound exceedingly well.

C. As the *processes* to be followed, moreover, are precisely similar to those which have been described for the removal of the fingers, there can be no necessity of recapitulating them here. I will remark only that the natural cavity which corresponds to the dorsal

surface of the metatarso-phalangeal articulations, and the prominence which the plantar surface forms in front and underneath, render amputation of each toe in its totality somewhat more difficult than that of the fingers, and that the ovalar method possesses still greater advantages for the appendages of the foot than for those of the hand.

D. The disarticulation of either of the three middle toes, scarcely produces the slightest alteration in the form of the foot. A young girl and a young man, in whom I had removed one of these toes, in consequence of a caries, earnestly desired me to do the same on the other side, in order, they said, that they might have the two feet equally narrow ! We shall see farther on what course in this respect is to be adopted for the first and fifth toe.

ARTICLE II.—AMPUTATION OF SEVERAL OF THE TOES AT ONCE.

Amputation of two, three, or of all the five toes could also be performed in the same way as for the fingers. It would be neither more complicated nor more difficult, and would present the same chances of success. There are so few wounds so serious as to implicate all the toes, without affecting at the same time a greater or less extent of the metatarsus, that the proposition made about twenty years since to amputate several of them at once appeared to be new, (Gautheret, *Thèse*, 1820.) Examples, however, had been related of such amputations, and especially in cases of frost bite. [See a note on this subject, Vol. I., Introduction. T.] A boy, aged sixteen years, was operated upon in this manner by Garengeot, (*Opérat.*, t. III., p. 416.) Also in the case of another boy a similar operation was performed at the hospital of Padua, (*Biblioth. de Planque*, t. II., p. 389, in quarto.) In one patient Bloch (*Biblioth. Chir. du Nord*, 116) performed this operation on both feet. In another case Delatouche (*Thèse*, Strasbourg, p. 5, obs. 12, 1814) says they were amputated completely (*nette*) by a bullet, and that no consecutive accident took place. M. Baud and M. Scoutetten (*Arch. Gén. de Méd.*, t. XIII., p. 67) have also both performed this operation with success. I have amputated, says M. Champion, all the toes in two soldiers, who were frost-bitten, always keeping in view to preserve to the foot, even if it were but a single phalanx, the greatest degree of support possible for the body. I saw at La Pitié, a patient operated upon in this manner by Lachapelle, more than forty years since. I have met with two other similar cases during the wars of the Empire. A recent case also has been published by M. Chaumet, (*Journ. Hebd.*, t. III., p. 83.)

ARTICLE III.—AMPUTATION OF THE METATARSUS.

The bones of the metatarsus are amputated like those of the metacarpus, and by as many different processes, either in the continuity or contiguity, or separately or all together, of which many examples have been given by Hey, C. Bell, Langenbeck, Ferrand,

Desault, Laumonier, MM. Moreau, Daniel, Aubry, &c. They may also be removed by extraction or evulsion, while at the same time preserving the corresponding toe.

§ I.—*Amputation of the Bones of the Metatarsus separately (seul à seul.)*

A. Amputation of the three *middle metatarsal bones* is performed quite frequently, and always after the same rules as for the amputation of the corresponding metacarpal bones. Some surgeons maintain even that it should have the preference over simple disarticulation of the toes. M. Thomas, for example, with whose opinion M. Petrequin (*Gaz. Méd.*, 1837, p. 367) seems partially to coincide, maintained in 1814 that it is less difficult and less dangerous than this last, and that the deformity which results from it is also less striking. This is evidently an error.

I. To remove any one of the middle bones of the metatarsus by the *ancient* method, it is necessary to divide by two successive (à deux reprises) incisions the whole thickness of the sole of the foot, to disturb (ébranler) some of the tarso-metatarsal articulations, and to produce a very extensive wound ; while the amputation of a toe, performed as it is in an instant, makes only a very trifling wound and one which is easier healed. Thus in the foot as in the hand, and for the same reasons, we must not attack the bones of the metatarsus only so far as it may be found impracticable to remove the whole of the disease by disarticulating the toes.

II. *Process of the Author.*—When this operation becomes necessary it is easily performed by the following process which I have already described under amputation of the bones of the metacarpus. I encompass the root of the toe with an oval incision, whose extremity is prolonged backwards upon the dorsum of the foot to beyond the limits of the disease. Afterwards detaching the soft parts upon each side and then underneath, I have soon isolated the bone, which I exsect with Liston's pliers, without dividing the sole of the foot, and which thus exhibits no trace of any cicatrix after the cure.

The three patients upon whom I operated in this manner rapidly recovered, and scarcely any traces of the mutilation were perceptible !

B. *Amputation of the First Bone of the Metatarsus.*—Some practitioners, and among them M. Gouraud, maintain that it is better to *disarticulate* the first bone of the metatarsus than to divide it with the saw. Ledran had already pointed out the disadvantages of this method while endeavoring to give popularity to the other, which has been generally adopted ever since M. Richerand recommended to saw the bone slantingly, (or taperingly, en bec de flûte,) in place of making the section transversely as was done in the last century. After disarticulation, the base of the wound represents a capital L, whose horizontal branch formed by the first cuneiform bone makes a disagreeable projection on the inner border of the foot. The

operation is besides more difficult, and the wound less easy to unite by first intention. Amputation in the continuity, when we take care to make the saw act in a very oblique direction from behind forwards, leaves no prominence on the inner side of the bone. It does not require so great a destruction of parts, nor that we should attack any articulation. I am of opinion, therefore, that it ought to have the preference so long as the disease does not oblige us to carry the instrument up to the tarsus. I have had every reason to be satisfied with these rules.

I. *Ordinary Processes.*—The different processes pointed out for the thumb and first bone of the metacarpus, are applicable to the metatarsal bone of the great toe. It was in these cases that Lebas (*Bulletin de la Faculté*, t. V., p. 417–490) and Bœclard at first made use of the ovalar method, that Richerand employed the V incision, and where the flap methods have also frequently been made trial of; but none of these methods have satisfied me in practice. These, then, are the processes which I have followed:—

II. As it is difficult *to draw the soft parts sufficiently inwards* from the plantar surface of the foot, and to plunge in the bistoury from above downwards, between the bone and the muscles; as it is almost impossible, moreover, in proceeding in this manner, to give to the point of the flap the regularity, width, and length desirable, I prefer making my incision from without inwards, and to trace out its extent and form by dividing the skin from behind forwards, first on the dorsal surface, then on the plantar surface nearly as far as the anterior extremity of the first phalanx of the great toe, and afterwards to raise up and dissect this flap while reversing it from its apex to its base. Having incised the integuments of the commissure in such manner that the borders of the whole wound pass outside of the head of the bone, we plunge the knife through the first inter-osseous space, while an assistant also draws the integuments outwardly as much as possible. We then divide the tissues with the full edge of the blade from behind forwards, bringing the knife out by the commissure of the two first toes. The knife being then immediately replaced behind, we divide above and underneath, on the inner and outer side, all the tissues which may be still adherent to the bone. A piece of wood or pasteboard, or even a simple compress folded several times and placed in the bottom of the wound, protects the soft parts against the action of the saw. The operator seizes with his left hand the toe and the articular extremity which he intends to remove, causes the foot to be turned outwards, applies his nail to the point where he wishes to begin the section, and then, with a small saw in his right hand, divides the bone at a very acute angle (*en biseau très oblique*) from its inner to its outer surface and from behind forwards.

One of the dorsal or inter-osseous arteries of the metatarsus, or one or two branches of the plantar arteries, occasionally, but not always, require the application of the ligature; the flap now brought upon the wound, should be adjusted to it accurately, and supported by strips of adhesive plaster and a suitable bandage.

III. *New Process.*—When the plantar surface of the foot is not too much degenerated, I proceed in another manner. An incision, to be carried along the inner border of the bone from the line of its posterior articulation as far as in front of the infra-phalangeal prominence, (bonrrelet,) enables us to detach, horizontally from above downwards, from within outwards, and slightly from before backwards, the whole thickness of the sole of the foot, and to form in this manner a flap which remains adherent in the whole extent of its outer border. A second incision, carried from one extreme to the other of the first, by crossing very obliquely the dorsal surface of the bone, and in such manner as to fall upon the first inter-digital commissure, then enables us to terminate the operation as in the process described above. We have thus a very regular wound, and a thick, large flap, which does not implicate (entamer) the sole of the foot, and which moulds itself exactly to the fibular side of the wound. It is a method whose results in practice are of the most satisfactory character, and one which I recommend to the profession.

C. *Fifth Metatarsal Bone.*—The last bone of the metatarsus might, like the others, be amputated in its continuity ; but the projection which it forms behind, the uselessness of any portion of it that we might preserve, the ease with which it can be disarticulated, and the little deformity that results from it, are the reasons why we generally prefer amputating it in the contiguity. This amputation is not to be made like the preceding ; the ovalar method is better adapted to it. If, however, we should not incline to make trial of this, we ought, with the bistoury held vertically, to cut through the whole inter-osseal space from before backwards, from the commissure of the fourth and fifth toes to the anterior face of the cuboidal bone ; then disarticulate the bone, pass from its dorsal to its plantar surface, detach its head, and cut a flap of sufficient length at the expense of the soft parts upon the outer border of the foot, and which flap can be made to cover with ease the whole extent of the solution of continuity.

§ II.—*Amputation of the Metatarsal Bones together.*

Though down to the time of Chopart surgeons were in the habit of having recourse to amputation of the leg for diseases even which did not complicate the whole of the foot, they not unfrequently, however, confined themselves to the partial removal of this part, which, at the present time, it is the prescribed rule to amputate as near the toes as possible.

I. According to Fabricius of Hilden, amputation of the metatarsus could not have been unknown to the ancients, who performed it with the chisel and mallet, and, without doubt, only in its continuity. In recommending it, Sharp (*Opér. de Chir.*, p. 390) advises that we should use a small saw, and states that he has once seen it performed with success. Hey revived it again at the end of the last century, and gives the case of a young woman, in whom he removed the first four toes, with a large portion of the cor-

responding metatarsal bones ; but he complains of the great length of time which the wound took to cicatrize. The operation is easier upon young persons, because, during infancy and in this part, the bistoury may very often be substituted for the saw. M. Raoult, in 1803, and M. Thomas, in 1814, recommended this operation in their theses, supporting it, as it appears to me, on very good arguments. In 1828, Murat and M. J. Cloquet (*Journ. Hebd.*, t. IV., p. 43) found that this operation fully answered their expectations. Since that time, M. Pezerat (*Journ. Compl. des Sc. Méd.*, t. XXXIII.) has performed it once, and with success ; and M. Mayor (*Journ. des Connaiss. Méd.-Chir.*, t. I., p. 138) who has also given his sanction to it, has been equally well satisfied with it. I cannot, in fact, understand why the transverse section of the metatarsus, rather than its disarticulation, should not have the preference whenever the disease admits of this operation.

I will also add that the first of these operations, if had recourse to in proper time, would, as it appears to me, render the other rarely necessary.

II. *Operative Process*.—a. A flap of the soft parts of greater or less length, is first cut, at the expense of the sole of the foot, by plunging a small knife into this part from one border to the other. We then divide by a semi-circular incision inclined slightly forward the skin and tendons of the dorsal surface at some lines in front of the point where we design to apply the saw. These soft parts (*les chairs*) being drawn back by an assistant, the surgeon, one after another, denudes the bones with his bistoury up to the base of the flap, in order to effect with greater ease their simultaneous or successive section from one side to the other, or from the dorsum to the plantar surface of the foot.

b. The process of M. Pezerat, which consists in making three flaps, one dorsal, one plantar, and the other on the inner border, ought not to be adopted, unless the diseased condition of the parts renders it impossible to employ the preceding process.

c. In concurrence with M. Champion (*Thèse, Resect. des Os, etc.*, 1815) and M. Mayor, it should, in my opinion, be adhered to as a rule to divide the bones as far as possible from the leg. A dorsal and a plantar flap of equal length, and even the circular incision, or the making one of the flaps shorter or longer, or the cutting out of two or three or four flaps instead of one, should be preferred, if the state of the soft parts seem to require it. Liston's pliers might also be advantageously substituted for the ordinary saw, and the dressing would require no special precautions.

[*Amputation of the Metatarsal Bones*.—Mr. Syme (Cormack's *Lond. and Edinb. Monthly Journ.*, &c., Feb. 1843, p. 94,) speaks of M. Liston's "happy employment" of straight cutting pliers, in exsections of the metatarsal and other small bones, instead of variously formed saws previously in use, as if it were something new in surgery. We are of opinion that the germ of this instrument is far more ancient than might be supposed, and an argument in favor of this is, that in early times when strength, and immediate and

obvious adaptation to the purposes in view, and not skill and adroitness, were most looked to, some such coarse, rude, but valuable article as, for example, the common cutting nippers of a blacksmith, to cut off, in an instant, protruded necrosed metatarsal and metacarpal bones, and those of the phalanges, would rather have been resorted to than the tedious, painful processes of sawing.

Certain it is, (see Vol. I., Prefatory matter,) a similar instrument to Mr. Liston's was constantly employed by me in the years 1831, '32, '33, at the Hospital of the Seamen's Retreat, New-York, for one or all the metatarso-phalangeal extremities of the metatarsal bones, in cases of necrosis, from having been frost-bitten, and which had been in some instances, *maltreated* by poulticing, &c. The bones, as I have said, were thus unsparingly clipped off, until the bleeding, excised surface of their extremities presented a fresh red and healthy appearance, though now buried half an inch or more in the tissues, and until the healthy appearance of the soft parts also indicated that the sections were made at the proper place. The soundness of this practice was made manifest by a fine, healthy stump, which was thereby procured without any trouble or danger of incising or dissecting the tissues for flaps, the necessity of which was superseded by excising the bones deep in the tissues; these latter, of course, in cases of frost-bite, as no constitutional taint exists, being rarely degenerated as far back as the bones. T.]

ARTICLE IV.—DISARTICULATION OF THE METATARSUS.

Upon the supposition that the state of the foot does not allow of making the section of the bones of the metatarsus, or that the surgeon does not wish to resort to this operation, it may be possible, by means of their disarticulation, to save the tarsus, and the use of certain important muscles.

§ I.

From surgeons being generally uninformed upon this subject, the operation in the year 1816 was looked upon as a new one. A great number of practitioners had, however, as we shall see, either recommended, or described, or even performed it! "As this amputation," says Garengéot, (*Opér.*, t. III., p. 414,) who has forcibly pointed out its advantages, "has to be made upon a considerable number of articulations which are not upon the same line with each other, it is one of a very embarrassing character. To conduct the bistoury between the bones of the metatarsus, &c., and to divide the ligaments which connect them, and to save as much skin as possible, are all the directions we can give."

Leblanc, (*Precis d'Opér.*, t. I., p. 310,) still more laconic, restricts himself to this remark: "We may, in certain cases, amputate a portion of the foot, saw through the bones of the metatarsus, or even separate them from their articulations, as has been stated by many practitioners." The same remark was made by Brasdor,

(*Mém. de l'Acad. de Chir.*) Vigaroux (*Œuvres Chirurg.*, etc., p. 250) performed this operation on the left foot of one of his patients, in 1764, and Laroche (*Encyclopéd. Méth., part. Chir.*, t. I., p. 107) enforces the necessity of preserving in the amputations as much of the foot as possible. In England, it was performed by Turner in 1787, (*London Medical Journ.*, 1787; *Gaz. Salut.*, 1789, No. 38.) Perey says he performed it, in 1789, with great difficulty on a monk of Clairvaux; and M. Larrey (*Clin. Chir.*, t. III., p. 671; *Mém. de Chir. Milit.*,) says he has been in the practice of performing it since the year 1793. We find it described also in the Thesis of M. C. Petit, in 1802. "I have," says Rossi, (*Méd. Opér.*, t. II., p. 229,) "by means of the cutting instrument, successfully extirpated the bones of the metatarsus, in a carious state, and saved the tarsus." In 1814, it was performed successfully by M. Berchu.

The following is the process given in 1803, by A. Blandin, who had employed it several times successfully: "I divide," says he, "the skin and tendons on the dorsum of the foot, by carrying the cutting edge of the bistoury from before backwards, and making it glide upon the body of the bones up to the place of their articulation, in such manner as to preserve a small flap, (dorsal;) I then divide all the ligaments; and afterwards, with the point of the instrument which I carry through the joint to below the tarsus, I complete the division of the bridges, and amputate the entire part with a single transverse section, preserving, as on the dorsum, a small portion of the tissues of the sole of the foot, in order to form a second flap."

M. Plantade in his Thesis, 1805, held nearly the same language. A child of four years of age, upon whom the operation was performed by Yatman, (*Bibliot. Méd.*, t. LIX., p. 261,) got well in fifteen days. Nevertheless, M. Villerminé and M. Lisfranc, who made this operation the subject of a special investigation, presented to the Institute in 1815, supposed that they were to some extent the authors of it. We are at least indebted to them for having given a careful description of the process to be adopted.

§ II.—Anatomy.

The three cuneiform bones united, present in front a kind of *mor-tice* slightly flaring (*évasée*) which is exactly filled up by the posterior extremity of the second metatarsal bone, and the inner wall of which cavity has a length of about four lines, with an inch in height, while its outer wall has hardly two lines in extent from before backwards.

The articulation of the *first metatarsal bone*, which is consequently found two or three lines farther forward than that of the third, is less wedged (*moins serrée*) than any of the others; its surfaces represent a double oblique plane, from within outwards, in the direction of a line which would strike on the middle of the metatarsal bone of the little toe, and then from above downwards, and from before backwards. That of the *metatarsal bone of the middle toe*, in other respects situated transversely like that of the

second, is found to be two lines in front of the bottom (au fond) of the mortice already described above. The interline of the fifth is oblique from without inwards, as if to strike upon the middle of the first metatarsal bone; while the fourth is almost horizontal on its outer part, and inclines in front like the preceding at the moment when it is about to become continuous with the third, being situated usually at one or two lines behind the latter.

As the *second metatarsal bone* is enclosed as it were between the bones of the tarsus, it is rare that the third cuneiform bone is not, in its turn, enclosed in another kind of mortice, of one or two lines in depth, formed by the third metatarsal bone in front, together with the second and fourth upon its sides. If the first did not exist, the second should equally be wanting. In fact, if the third cuneiform bone was upon the same plane as the second, the articulation would be perfectly regular from the outer border of the foot to the first; but this bone often makes so considerable a projection, that it reaches nearly to a line with the first cuneo-metatarsal articulation. In such cases, the disarticulation of the two mortices is attended in both with nearly the same difficulty. Other anomalies also are sometimes met with. I have, for example, seen the antero-internal articulating surface (facette) of the cuboid bone extend half a line, or even a line, beyond the metatarsal articulating surface of the third cuneiform. In another subject, the two last metatarsal bones united, resembled a sloping ridge, (un dos d'âne,) the crest of which, placed vertically, was sunken to a depth of three lines upon the front of the cuboidal bone; and this was found to exist in both feet of the same subject. On another occasion, I found the dorsal border of the extremity of the third metatarsal bone inclined obliquely backwards, to the extent of a line and a half, upon the corresponding cuneiform bone. M. Zeigler has seen the tubercle of the fifth metatarsal bone prolonged as far as the line of the articulation of the os calcis. I have often noticed, also, in persons who are in the habit of wearing tight (etroites) boots, that a tubercle, resembling an exostosis, will very frequently be formed upon the dorsum of the second cuneo-metatarsal articulation. Finally, several of these articulations may become anchylosed.

The dorsal tarso-metatarsal ligaments, the antero-posterior as well as the transverse, being nothing more than simple bandelettes or ribbons, do not require any special description. On the plantar surface, however, it is somewhat different. There these bones terminate, almost all of them, in a sort of flattened edge or crest, which, by permitting them to incline towards each other, forms the transverse concavity of the foot, leaving between them small triangular spaces, which are filled by fibrous bundles. One of these fasciculi, (faisceaux,) viz., that which unites the outer surface of the anterior projection of the first cuneiform bone to the inner surface of the second metatarsal, merits every attention from the operator. It is especially remarkable by its thickness in a vertical direction, bounded by that of the articulation itself; as to the others, there is nothing of any special importance to remark concerning them.

Viewed in its ensemble, the tarso-metatarsal articulation represents a line slightly convex forwards, and the extremities of which correspond nearly to the middle of the space which lies between (sépare) the malleoli and the roots of the toes. Upon the outside, it is designated by the posterior extremity of the tubercle of the last metatarsal bone, observable under the skin. On the inner side it is also very easy of recognition, by observing that the first cuneiform and the first metatarsal bone, each present a prominence under the integuments near the plantar surface of the foot, which gives the articulation the appearance of being depressed. A line, drawn transversely from the outer extremity of the articulation to the inner border of the tarsus, falls a little in front of the scaphoid bone, and is distant about three-quarters of an inch from the tarso-metatarsal articulation on the inside. It cannot, therefore, be a matter of much difficulty, before proceeding to the operation, to identify both its direction and position. As it is to the lower or plantar tubercle of the posterior extremity of the first metatarsal bone that the tendon of the peroneus longus muscle is attached, and that this tendon usually contracts some adhesions as it passes under the third cuneiform bone, the mere disarticulation of the metatarsal bones does not necessarily destroy its action. It is the same with the peroneus brevis and peroneus tertius muscles, which are inserted in part, at least, upon the dorsal surface of the cuboid bone, and also with the tibialis anticus and tibialis posticus muscles, whose continuity, in like manner, is not destroyed by the disarticulation of the first bone of the metatarsus.

The disarticulation of the metatarsus is, without doubt, one of the most difficult operations that we can encounter. To perform it, most authors who have described it recommend that we should employ at the same time both the bistoury and the saw.

§ III.—*Partial Disarticulation.*

Instead of removing the whole metatarsus, it may be sometimes practicable to take away only a portion of it. Briot (*Progrès de la Chir. Milit.*, p. 187) states that a patient, in whom he removed the two last bones of the metatarsus and the corresponding toes, was afterwards enabled to walk without difficulty. The same was the case in the patient operated upon by Béclard, (*Arch. Gén. de Méd.*, t. V., p. 182.) M. Bouchet (Montfalcon, *Etat Actuel de la Chir.*, p. 44) states that he has, in the same manner, removed the third, fourth, and fifth metatarsal bones. In one case of Béclard, (*Arch. Gén. de Méd.*, t. V., p. 186,) he took away only the two first. M. Onvrard (*Mélanges de Méd. et de Chir.*, p. 221) succeeded also in removing the third and fourth, and in preserving the fifth. M. Macfarlane (*Gaz. Méd. de Paris*, 1836, p. 515) has removed the second metatarsal bone only, together with its toe; but in such cases disarticulation should be interdicted.

The disarticulation of the metatarsus endangers inflammation of all the joints of the foot, is tedious and difficult of execution, and

possesses no advantage over the section of the bones a little in front. When the metatarsal bone is laid open upon its dorsal surface, by means of a very long ovalar incision, it should be divided by the rowel saw, (*la molette*,) if the disease has extended very far, or, in the contrary case, by Liston's pliers. Thus modified, the operation becomes rapid and simple.

§ IV.—*Disarticulation in mass.*

A. *Process of Hey.*—In a young girl of eighteen years of age, operated upon in 1799, by Hey, he made a transverse incision at the distance of about half an inch in front of the articulations; then made another upon each side, from the corresponding extremity of the first to the root of the first and fifth toes. In order afterwards to form a flap, he detached all the soft parts from the plantar portion of the foot, and turned them back. After having disarticulated the four last metatarsal bones, he decided also upon removing the projection of the first cuneiform bone, which he did by means of the saw. The patient recovered perfectly.

B. *This process* is as good as any other, except that the lateral incisions and the precaution of forming the plantar flap, before disarticulating the bones, render the operation both longer and more difficult. Hey, in remarking that the four last metatarsal bones are found nearly upon a line, wishes to convey, as I understand him, that their respective posterior articulating surfaces extend but very little beyond each other, and not as they have made him say, that they form a perfectly transverse line. As to the section of the first cuneiform bone, it does not, in my opinion, deserve the censure which our surgeons have undertaken to cast upon it. Béchard (*Bull. de la Fac. de Méd.*, t. VI., p. 319; *Archiv. Gén.*, t. V., p. 194) and M. Scoutetten (*Arch. Gén. de Méd.*, t. XIII., p. 54) have performed this operation, and have had no reason to be dissatisfied with it.

C. *Process of Turner.*—Turner, who recommends saving as much of the skin as possible, after having divided the soft parts, made the section of the bones upon their dorsal surface. M. J. Cloquet (*Dict. de Méd.*, t. II., p. 171) also thinks it better, after having formed an upper flap, that we should make a transverse section of the bones rather than stop to disarticulate them. M. Blandin attributes this process to Béchard, who has not, that I am aware of, published it anywhere. It is probable that M. Blandin confounds the section of the first cuneiform bone, which in fact was performed by Béchard, with the proposition of M. Cloquet. I do not know that any other person than Murat, (*Journ. Hebdom.*, t. III., p. 44,) who once performed it successfully at the Bicêtre, in 1828, has ever employed it; but I cannot perceive how it can be more dangerous than simple disarticulation; *à priori*, in fact, we would be led to believe that it would less frequently be followed by serious accidents. The laceration, instead of the incision of the ligamentous, or fibrous tissues, which appears formidable to some persons can-

not be as injurious as the tractions which we are compelled to make upon the articulations of the tarsus, when we undertake to separate the metatarsus from it with the knife. The surfaces of the sawed bones are fully as favorable to the immediate union of the wound as would be the cartilaginous surfaces.

The recommendation of M. J. Cloquet, which appears to have been only intended by him for those surgeons who had not had it in their power to make themselves sufficiently familiar with the tarso-metatarsal disarticulation, has been adopted by M. Mayor, who takes upon himself the responsibility of laying it down as a law, justifying in every particular, by his own practice, what I have said above, and what I had already stated in this work, in the edition of 1832.

D. *Process of M. Lisfranc.*—I do not give the process of M. Villermé, because that physician himself avows that that of M. Lisfranc is to be preferred.

E. I shall, however, now give a description of the process which I employ, after my own trials with it, that all the responsibility of it may rest with the author.

I. *First Stage.*—We make use of a narrow strong knife for all the stages of the operation. A good bistoury, however, would answer until we have nothing farther to do than to make the palmar flap. If the surgeon is ambidexter, he commences on the outer border of the foot, holding the knife in the right hand, for the right limb, and in the left hand for the left limb; otherwise, we begin in the last case upon the inner border of the metatarsus. An assistant seizes hold of the lower part of the leg, compresses the posterior tibial artery behind the internal malleolus and the anterior tibial upon the instep, at the same time that he draws back the skin on this last-mentioned part. The operator first identifies the extremities of the articular line, and with one hand embraces the point of the foot upon its dorsal surface, in order to act more freely upon the entire metatarsus. With a knife in the other hand, he makes a semilunar incision, with its convexity forward, and at six to ten lines in front of the articulations. The instrument is reapplied to the first incision, in order to divide, on a line with the retracted skin, the extensor tendons and other soft parts which may remain adherent to the bones, and in such manner that this second incision may correspond with the line of the articulation. In arriving at the border of the foot, it is important not to descend too low towards the plantar surface, for in terminating the operation we should not then be enabled to give all the breadth required for the base of the principal flap.

II. *Second Stage.*—If the articulation has not been laid open with the same cut which has divided the tendons, we enter it by carrying the point of the knife behind the tubercle of the fifth metatarsal bone, in the direction of a line which, extending obliquely forward, (en devant,) would fall first upon the head, then on the middle portion, and then on the posterior extremity of the first metatarsal bone, making the incision almost transversely in arriving at the ar-

tication of the fourth metatarsal bone, and inclining it again in front at the moment of entering the articulation of the third, which latter is separated by immediately directing the instrument transversely.

The second bone of the metatarsus prevents us usually from going any farther in this direction. We then withdraw the knife, in order to apply it, with the point directed upwards, to the inner border of the foot, so as to divide from within outwards, and from behind forwards, the articulation of the first metatarsal bone. The surgeon then immediately places it in a perpendicular position with its point downwards, and turns its edge backwards upon arriving at the second metatarsal bone or upon the inner side of the cunean mortice (*mortaise cunéenne*;) then plunges it towards the plantar surface of the foot, and as far as the line of the apex of the articulating surfaces, (*vers la plante du pied jusqu'au niveau du sommet des facettes osseuses*;) then pressing against its handle as if to give it a vibratory movement, (*le faire basculer*;) from behind forwards, and then from before backwards, he divides the great ligament, which is *the key of the articulation*. Withdrawing it again, in order to come upon the posterior articulating surface of the second metatarsal bone, he places its point horizontally transverse upon the superficial surface of this bone. As the joint is never more than three lines behind, it is easy to open into it by cutting successively at distances of half a line at a time from the articulation of the middle metatarsal bone which is already laid bare, until we shall have reached that of the second. All the articulating surfaces are now laid open, and the point of the knife being inserted between them, readily divides all the remaining ligaments.

III. *Third Stage*.—There now remains nothing more to do than to form the plantar flap by grazing the plantar surface of the bones [with the edge of the knife, until it reaches] nearly as far as the metatarso-phalangeal articulations. This flap should be an inch longer on the inner than it is on the outer side; also it should be made to terminate in a bevelled, (*en biseau, i. e., shelving*;) and not a square-shaped edge, and in order that it may adapt itself better to the semicircular curvature of the dorsal border of the stump, it should be slightly rounded upon its digital extremity, and not be made wholly transverse. If we prefer having its inner fully as thick as its outer border, we must take care while cutting the flap, to hold the handle of the instrument in a much more elevated position than its point; and in order that the phalangeal head of the metatarsal bones, that of the first especially, may not arrest the blade of the instrument, it is important to give to its cutting edge, and that at an early period, a strong inclination towards the skin.

IV. *Dressing*. The arteries divided and requiring torsion or the ligature are the internal and external plantar arteries, the dorsalis pedis, and some other secondary branches of little importance. The principal flap being raised up against the articular surface, ought to cover it exactly and have its border adjusted back against (*s'adosser*) the little flap which should have been preserved upon

the dorsal surface. If upon this last-mentioned surface the integuments should have been divided upon a line with the articulation, the bones of the tarsus would not fail to become denuded immediately after. It is easy then to conceive that it would be a difficult thing to cover them conveniently with the lower flap. As the tendons retract less than the skin, should they have been divided also at the first incision, their extremities might obtrude between the lips of the wound and considerably interfere with its union by first intention. It is better, therefore, to exsect them with the scissors. The strips of adhesive plaster, in order that they may more firmly sustain the coaptation of the parts, ought to be made to reach from the postero-internal and lower surface of the heel as far as to the stump, then extending longitudinally over the dorsal surface of the foot, they should be made to pass round the lower part of the leg or at least be carried to the neighborhood of the malleoli.

The patient having been carried to his bed, should be placed in such manner as that the leg and foot upon which the operation has just been performed, may rest on their outer side, and be in as perfect a state of relaxation as possible. Here, as after all amputations of the extremities and still more so here than under any other circumstances, methodical compression [by bandages] from the lower third of the leg nearly as far as to the vicinity of the wound, would be one of the best means we could adopt to prevent the development of synovial, venous, or any other form of inflammation.

F. *Process of M. Maingault.*—Having in the year of 1829, conceived the idea of cutting out the plantar flap at first by plunging the knife by puncture between the soft parts and the bones, with the view of then disarticulating the tarsus, in the direction from the plantar surface to the dorsum of the foot, I soon after made several trials of it upon the dead body, in the rooms of the School of Practice, and afterwards at the hospital of St. Antoine; but having found it more difficult to disjoint upon this side than upon the dorsal surface, I had entirely renounced it without having made it public, when M. Maingault, (*Bulletin de Férussac*, t. XIX., p. 60,) who had devised the same process, gave a eulogistic account of it to the Academy. His method in this case is exactly similar to the one he has proposed for the disarticulation of the metacarpus. Though practicable, it has appeared to me, all things being considered, less advantageous and more difficult than the preceding, and consequently of no utility but under circumstances where it would not be possible to adopt the latter.

ARTICLE V.—DISARTICULATION OF THE TARSUS.

When the bones of the tarsus themselves are affected, the removal of the metatarsus alone is manifestly insufficient. We then take away separately or at one operation the three cuneiform bones, and the cuboid and scaphoid.

§ I.—*Partial Disarticulation.*

If the cuboid bone and the two metatarsal bones which it supports should be alone diseased, we might after the manner of Hey remove only the outer third of the foot. Unless there should be an absolute necessity, we should not amputate the whole of the tarsus. We must confine ourselves to the disarticulation or amputation of the bones that are affected. The patient mentioned by M. Villermé, (*Journ. de Méd. cont.*, 1815, p. 32,) and who died at the expiration of six weeks, had had the three cuneiform bones and the corresponding portion of the metatarsus, removed. M. Ruyer, (*Révue Méd.*, 1832, t. IV., p. 187,) in removing the great toe and the metatarsal bone which supports it, and also the two first cuneiform bones, was enabled to save the four last bones of the metatarsus. The cuboid bone and the two metatarsal bones which are articulated to it in front, have, together with the fourth and fifth toes, been removed with a no less fortunate result, first by Béclard, (*Arch. Gén. de Méd.*, t. V., p. 190,) then by M. McFarlane, (*Gaz. Méd.*, 1836, p. 516,) which operation has also been successfully performed in Holland by M. Kerst. These operations, moreover, are in their character extemporaneous, and if I may use the term, *magistral*, (magistrales,) whose manipulating processes cannot be laid down in advance. It is necessary that the surgeon should invent them in some sort, every time he is obliged to perform them. The incisions of M. Kerst have some analogy to those which I recommend for amputation of the first metatarsal bone; if somewhat modified they would have answered equally well in the process of M. Ruyer, (See *ersection of the foot.*)

[Where one of the tarsal bones only is carious or degenerated, it may, Mr. Syme thinks, (*Cormack's Lond. & Edin. Monthly Journ.*, &c., February, 1843, p. 95,) be taken away at the same time with its corresponding diseased metatarsal bone. Thus the first metatarsal with the internal cuneiform bone, and the os cuboides with the two metatarsal bones articulated to it, &c. T.]

§ II.—*Disarticulation in mass.*

Amputation between the os calcis and astragalus on the one part, and the scaphoid and cuboid bones on the other, is like that of the metatarsus, an operation, the origin of which can be traced to the ancient writers, and would have belonged entirely to France, had not Fabricius of Hilden clearly alluded to it, and several persons actually described or performed it before the time of Chopart, and which operation since its discovery has, in reality, only been brought to perfection by our own countrymen. It is therefore somewhat strange that up to the present time the honor of this operation should have been given to Chopart, who never spoke of it until in the year 1787. Hecquet of Abbeville, however, in the year 1746, showed to Winslow (*Acad. des Sc. Hist.*, p. 58, 1746, in 12mo.) a foot which had been separated in front of the astragalus and os

calcis. Vigaroux, (*Œuvres Chir.*, etc., p. 250,) however, in the year 1764, declares that he had amputated the foot at the tarsus for a gangrene. Lécât, (*Mercur de France*, Dec., 1752, 2e partie. Majaut, *Prix de l'Acad. de Chir.*, t. III., p. 232,) moreover, had had recourse to it and formally recommended it in 1752. But A. Petit, (*Méd. du Cœur*, p. 365,) who had performed it twice before the year 1799, did not make known his observations until after Chopart.

A. *Anatomy*.—The articulation separated by Lécât, is infinitely less complicated and less difficult to disunite than the preceding. The four osseous surfaces which compose it, possessing some degree of mobility, are far from being as closely wedged together (*serrées*) as those of the tarso-metatarsal articulation. The rounded head of the astragalus is maintained in the cavity of the scaphoid bone, by means only of loose fibro-cellular bands, (*rubans*.) On its outside and on its dorsal surface the same arrangement exists for the os calcis and the cuboid bone. The strongest and most important ligament of this joint is that which passes deep down from the os calcis to the fibular extremity of the scaphoid, and which may also be denominated the *key of the articulation*, (*la clef de l'articulation*.) The articular line in this part is divided into two very distinct portions. Its inner or astragalean half represents a half-moon with a very regular anterior convexity. Its outer or calcanean half on the contrary represents an oblique plane from within outwards and from behind forwards; so that in blending with the other it forms a sinus of considerable depth, which seems to be continuous with the dorsal cavity of the os calcis, and where we may be easily misled at the time of the operation, if we do not accurately call to mind the disposition of the parts.

Like that of the metatarsus, the articulation of the bones of the tarsus with each other, is exceedingly concave and unequal upon its plantar surface, where the scaphoid and cuboid bones form a projection which must not be forgotten when we are about to separate the soft parts from them. Its inner side is marked by a slight depression which is bounded behind by the tuberosity of the os calcis, and in front by the corresponding tubercle of the scaphoid, a tubercle which we no longer search for at the present day, in order to strike between the astragalus and the os naviculare. On the outside, the articulation of the tarsus is found at eight or ten lines from the posterior extremity of the fifth metatarsal bone, near the middle of the space which separates this tubercle from the small crest, on the outer surface of the os calcis, to which is attached in front the tendon of the peroneus longus. Upon the dorsum of the foot, the articulation under consideration is indicated by the slightly depressed line which is felt by the finger in front of the head of the astragalus.

Anomalies may form exceptions to these rules. The tubercle of the scaphoid is sometimes scarcely perceptible. In other cases the tendon of the tibialis posticus becomes the seat of a sesamoid bone which in great part effaces the articular depression. M. Pichon

(*Thèse* No. 261, Paris, 1828) has remarked, that the calcaneo-scapuloidean ligament, or that species of *articular key* mentioned above, may be transformed into an epiphysal cartilage, and become completely osseous, even in quite young persons. He has several times met with this peculiarity, and while sustaining his thesis exhibited a specimen of it before the Professors of the Faculty. We can readily conceive the difficulties the surgeon would encounter in such cases in terminating his operation. It was this without doubt which had produced the species of ankylosis which M. A. Cooper was compelled to break before finishing a partial amputation of the foot; and the same as that spoken of by M. Fisher, (*Nouv. Bibl. Méd.*, 1829, t. II., p. 432,) and which would have yielded only to the saw, if it had been necessary to amputate in this case during life. M. Plichon also remarks, and with reason, that the head of the astragalus extends much farther in certain cases than in others beyond the line of the anterior surface of the os calcis, and that the calcaneo-cuboidal articulation is then less oblique in front.

B. Operative Process.—The manner of disarticulating the scaphoid and cuboid bones has necessarily varied only in its less important details. Chopart, who did not have the advantage of the anatomical knowledge which we possess to-day, spoke of it as an operation of considerable difficulty. It is a fact that in 1799 Peltan was nearly three-quarters of an hour in performing the operation; though he had before him the foot of an articulated skeleton; but since M. Richerand and Bichat demonstrated that we may always feel under the skin the projection of the inner extremity of the scaphoid bone, the difficulties which accompany the operation have become so much lessened, that it is at the present time one of the most easy in surgery.

I. Process of Chopart.—The limb and the surgeon should be placed as in the preceding disarticulation. A transverse incision is first made at two inches in front of the malleoli. Upon the extremities of this incision the operator makes two others of slight extent; dissects up the trapezoidal or quadrilateral flap which they form, and turns it back upon the leg; opens the articulation from the inner to the outer border of the foot; divides the calcaneo-scapuloidean ligament in passing through the joint; arrives upon the plantar surface of the scaphoid and cuboid bones, and finishes with the incision for the lower flap, which he prolongs to near the extremities of the metatarsal bones.

[*Chopart's operation*, notwithstanding it had been so long in use on the continent, was never, as Mr. Syme thinks, (Cormack's *Lond. and Ed. Month. J.*, &c., Feb., 1843, p. 95,) performed at Edinburgh until by him in 1829, (*Quarterly Report of the Edinburgh Surgical Hospital, Edinburgh Surgical and Medical Journal*, 1842;) since which he has practised it repeatedly with the most satisfactory results, and without any inconvenience from the danger apprehended that the predominant power of the tendo Achillis would cause a pes equinus of the stump. Mr. Syme found that the cut extremities of the tendons on the fore part of the joint

speedily acquired new attachments which enabled them to counteract this antagonism. This opinion we shall see has not been verified by the experience of other surgeons. T.]

II. *Process of M. Richerand*.—M. Walther gives a little more, (Rust's *Handb. der Chir.*, t. I., p. 674,) and M. Graefe (*Ibid.*) a little less length to the dorsal flap; in other respects their description of the partial amputation of the foot is the same as that of Chopart. The modification proposed by Bichat and M. Richerand has been long since adopted in France, that is to say, instead of circumscribing a dorsal flap by three incisions, we confine ourselves to one incision which is semilunar with its convexity forward, and made at a few lines only in front of the articulation. Klein and M. Rust (*Ibid.*) making this flap still shorter than that of Chopart, propose to go at once into the articulation. M. Rust recommends that a long incision should be made on each border of the foot to trace out beforehand the form of the plantar flap.

III. *Process of M. Maingault*.—M. Maingault recommends that we should in the same way as for the metatarsus and metacarpus, proceed from the plantar to the dorsal surface in disarticulating the bones of the tarsus, and considers that this new process should be adopted at least in certain cases. On that point I coincide with him entirely.

IV. It appears to me superfluous to discuss the relative importance of these various modifications of the general operative process; all of them may find their application in practice. If there were no soft parts that could be preserved except upon the dorsal surface, for example, it is clear that we must take them from here, and that we should on the contrary take them wholly from the plantar region, if the integuments were degenerated upon the dorsum of the foot nearly up to the leg. If there were neither sound tissues enough above nor below, to enable us to obtain a flap to cover the wound, I cannot see why we might not decide upon cutting two of them of equal extent. But when the sole of the foot is not too much disorganized, the course recommended by Bichat is unquestionably the most rational and the best. A semi-circular incision from one malleolus to the other, as advised by M. Bougard, (*Annales Cliniques de Montpellier*, 2e série, t. IV., p. 68, 1829,) would have no other advantage than to give a little greater length to the wound.

V. *Process adopted by the Author*.—*a. First Stage*.—Therefore, while the assistant who compresses the arteries draws back the integuments, the surgeon with one hand embraces the back of the foot, and with a small knife in the other makes an incision slightly convex at an inch in front of the articular line, and carries the same from the inner to the outer border of the foot for either limb, if he is ambidexter, or from the outer to the inner border for the left foot, when he can use only his right hand with confidence. After having caused the tissues to be drawn back, he reapplies the instrument to the wound and divides in the same direction and near to the retracted skin, the tendons and other tissues (lames) which

still cover the osseous surfaces, and may almost always enter the articulation by this second incision.

b. Second Stage.—If not, after again assuring himself of the position occupied by the scaphoidal tubercle, the surgeon divides upon the whole extent of the dorsal surface, and from within outwards, the fibrous bands which unite the scaphoid bone to the astragalus without endeavoring to penetrate into the joint; seeing that the head of the last-mentioned bone, (the astragalus,) encased and hidden in the cavity, and as it were overlapped (*abritée*) by the thin border of the other, (the scaphoid,) would form an obstacle to his doing so; he therefore describes a semi-lunar incision, being particularly on his guard not to prolong the outer branch of it too far backwards, but taking care on the contrary in order to disarticulate the cuboidal bone, to incline the cutting edge of his knife, first transversely, and then a little forward, and as soon as the articulating surfaces are separated wide enough apart to admit of it, to make the section of the thick fibrous bundle (*trousseau*) which unites the *os calcis* to the scaphoid, in order to reach the deep-seated surface of the articulation.

c. Third Stage.—The operator then directs the cutting edge of his instrument forwards; grazes the under surface of the tarsus, and cuts the plantar flap; depressing the wrist, if it is the left tarsus, and elevating his wrist on the contrary if it is the right; [See first stage above. T.] in order that this flap may not be thinner on the inner than the outer side, and prolongs it a little more on the inner than on the outer border, because of the astragalus which rises much higher towards the leg than the *os calcis* does. As the vertical extent of osseous surfaces exposed is greater than after the metatarsal disarticulation, the flap should be prolonged forwards almost as far as for this last, although it was commenced nearly two inches farther back.

d. M. Sédillot in order to give greater exactness to this process, and following out what I have said of it above, forms his inner flap precisely in the direction of the great diameter of the astragalocalcanian surfaces. We have thus a narrow wound, giving a linear cicatrix, easy to unite and to be kept united, allowing a free discharge to the pus, and requiring but little integuments to cover it. Every person is aware how difficult it is to cut out a plantar flap of sufficient length in the disarticulation of the metatarsus and tarsus. *M. Sédillot* (*Communiqué par l'Auteur*) has pointed out an expedient which removes the embarrassment. All that is required is, that while grazing the plantar surface of the metatarsal bones, the cutting edge of the instrument should be made to fall upon the sesamoid bones of the great toe. The knife which is constantly found to catch at this point, must be made to pass around it, when by incising through the integuments at two to three lines in front of it we obtain a suitable flap.

e. Dressing.—To tie the arteries in proportion as they are divided, as *Chopart* advises, is a useless precaution. The only arteries

after the operation that demand attention, are the *dorsalis pedis* and the two plantars. The dorsal integuments are now immediately brought in front, and the plantar flap is raised up, and kept upon the cartilaginous surfaces by means of long strips of adhesive plaster, and a roller bandage methodically applied.

C. *Consequences*.—The cure, after this operation, may possibly be effected in fifteen or even ten days. It is liable to all the accidents of other amputations. Inflammation and suppuration in the neighboring articulations, or of the tibia and os calcis, would be a very serious accident. This inflammation proved fatal in a patient of M. Lallemand, (*Ephémér. de Montpellier*, Journal Analyt., 1829, p. 413,) by extending to the leg by means of the tendinous grooves, (*coulisses*.) A young man also operated upon by M. Simonin, (*Décade Chir.*, 1838, p. 1,) was seized with delirium and died. But the reversion of the heel is the inconvenience which has been most usually complained of. This is a real difficulty, and has been established by M. Larrey. It occurred in a patient I saw in the Hospital of St. Louis in 1820, which case is referred to also by M. Mirault, (*Arch. Gén. de Méd.*, t. V., p. 195.) A second patient, also amputated at the Hospital of Saint Louis, presented another example of it in 1836. M. Fleury (*Ephémér. Méd. de Montp.*, t. II.) has also seen a case. M. Blandin, therefore, (*Gaz. Méd. de Paris*, 1838,) who questions its reality, is mistaken. Means have even been proposed both to prevent and remedy it. M. Berchu, for example, supposes that it might be prevented by keeping the leg flexed after the operation.

In adopting this opinion, M. Lallemand recommends the limb to be placed upon its outer side. M. Mirault thinks we should do better by applying a roller bandage to the whole of the leg; but there are no grounds to suppose that such expedients would have the least efficacy. In the patients in whom I have noticed the reversion of the heel, it was evidently owing to the impossibility of uniting the wound by first intention, and because the border of the plantar flap had not been attached to the dorsal border of the wound. The best preventive means, therefore, consists in doing everything in our power to accomplish agglutination, or at least partial union of the two lips of the wound.

It has been, moreover, supposed that the section of the tendo Achillis would overcome this retraction. M. Champion formally proposed this, in supporting his thesis in January, 1815, and M. Villermé believed that the idea originated with him; but Antoine Petit had done better, (*Disc. sur les Mal. Obs. à Lyon*, p. 364;) having had recourse to this auxiliary operation in one of his two patients, he obtained complete success. With this claim, we may even say that A. Petit is the inventor of tenotomy in France. When, however, the flaps have been well constructed and are well supported, the retraction of the tendo Achillis, after amputation of the tarsus, occurs only as an exception. Neither M. McFarlane nor Dupuytren have seen it. It occurred in none of the five cases that I operated upon, and M. Blandin says he has met with it

but once out of the eleven of these amputations that he has performed.

ARTICLE VI.—COMPARATIVE VALUE OF THE TWO MODES OF PARTIAL DISARTICULATION OF THE FOOT.

Since surgeons have demonstrated that it is quite as practicable to disarticulate the metatarsus as it is the whole anterior range of the bones of the tarsus, it has been asked which of these two operations should have the preference. A question like this ought not to have been propounded. These operations are not calculated to replace each other, and each has its special applications. When disarticulation of the metatarsus suffices, amputation after the manner of Chopart becomes useless; in the same way as when the disarticulation of the scaphoid and cuboid bones admits of our removing all the disease, there is no need of amputating the leg. Some persons, however, still seem to be of the opinion that, even where the disease does not extend beyond the metatarsus, it is better to amputate like Chopart. To support this proposition, they argue upon the difficulties of the tarso-metatarsal disarticulation, the few advantages that can result from it, the severe pain it must produce, and the greater dangers that must ensue from it. The synovial membrane, which lines the anterior cunean (*cunéenne*) and cuboidal articulating surfaces, being continuous with that of the cuneo-scaphoidal articulations, is, says M. Blandin, (*Nouv. Biblioth. Méd.*, 1828, t. I., p. 212,) the reason why inflammation, when once developed here, is readily propagated to all these anfractuous surfaces, and terminates in their disorganization.

To these reasonings it may be answered: 1, That with exact anatomical knowledge, we may succeed in performing the operation in question without any great difficulty; that a single cut of the saw, moreover, would speedily relieve the embarrassment, if any should occur from the projection of the first cuneiform, or of the second metatarsal bone; 2, that the section of the ligaments and the separation of all the bones, may be made with such rapidity as to cause no great severity of pain, if we take the trouble of dividing instead of tearing the fibrous tissues; 3, that the inconveniences which are spoken of, are, up to the present time, based upon little else than conjectures, and that this operation has not been performed sufficiently often to enable us to draw an exact parallel between it and that of Chopart; 4, as to the disposition of the cartilaginous surfaces, it is such in fact that the *surface*, not the *synovial membrane*, of the second cuneiform bone, is quite *often* not *always*, where it unites with the great cuneiform bone, continuous with that of the anterior surface of the scaphoid; but is it quite true that the synovial head of the astragalus, and the anterior surface of the os calcis which is also sometimes continuous between these two bones as far as the cartilaginous pulley of the last, has less extent than that of which we have just been speaking?

The new operation gives a length to the foot which easily ad-

mits of standing and walking and the movements of flexion and extension. It causes but a trifling deformity, which may be easily concealed by giving a slight modification to the shoes. In the method of Lécat it has often happened, as I have said above, that the heel is turned back to such extent as not to allow of the patient walking with a simple buskin. This inconvenience, it is true, is quite rare; but it is possible, however, and in itself is a sufficiently serious thing. It is not owing to the extensor tendons of the foot having been divided. It is known that these tendons, after their section, scarcely retract, and that they contract firm adhesions to the cicatrix; but the posterior branch of the lever represented by the foot, being left in some sort by itself, the tendo Achillis thereby acquires a predominance over it which it was far from having before.

If this operation presents at the present time numerous examples of success, it has also alike had its reverses; and if the other has sometimes caused death, it has also been performed with perfect success by Percy, Hey, Blandin, Berehu, Bœlard, Janson, Miquel, Lisfranc, Kluyskens, Zine, Scoutetten, Guthrie, Bedor, (*Rév. Méd.*, 1823, t. III., p. 379,) Jobert, (*Journ. Hebd.*, 1828, t. II., p. 336,) and Ouvrard, (*Mél. de Méd. et de Chir.*, t. I., p. 138.) The safety and interest of patients therefore require that both these operations should be retained in practice, and neither of them substituted for the other.

If the surface of the *os calcis* and of the *astragalus* should be altered, and the disease has extended only to some lines in depth, ought we in that case to renounce the partial amputation of the foot? M. Roux, in one of his cases, having struck behind the joint which he wished to open, immediately decided upon removing with a saw the projecting portion of the two first bones of the tarsus. Serious accidents followed, and the patient ultimately died; the tibio-tarsal synovial membrane had unfortunately been opened during the operation. I would not follow the example of M. Roux where the articulation is healthy. But if the cartilaginous surface of the astragalus and os calcis were affected, it is my opinion that this modification ought to be adopted, and that we would thereby avoid the necessity of sacrificing the patient's leg; it being understood that we should take every necessary precaution to avoid the accident of which I have spoken. This advice, and which I gave in 1832, has been attended to. M. Mayor (*Journ. des Conn. Méd.-Chir.*, t. I., p. 138) followed it in four cases, and it does not appear that anything serious ensued. We have therefore in this another modification of partial amputation of the foot.

ARTICLE VII.—DISARTICULATION OF THE FOOT.

§ I.—*The whole Foot.*—(En totalité.)

From the rule laid down, in other respects so just, that we should amputate the least quantity of parts possible, surgeons have repeatedly asked the question, whether if disarticulation of the foot would

carry out our intention, it ought not to be preferred to amputation of the leg; and whether after this disarticulation it would not be possible for the patient to walk with a particular kind of shoe, or a sort of buskin which would conceal his deformity? It was once successfully performed by Sedillier, and Brasdor (*Mém. de l'Acad. Royale de Chir.*, t. V., 1819,) asserts that the cicatrix which was completed in a short time, never re-opened during the twelve years that the patient survived. Hippocrates, Fabricius of Hilden, and Scultetus, appear also to have alluded to it but in a very vague manner. Since then, other persons have again proposed it, but without being enabled however to effect its adoption. Rossi (*Med. Oper.*, t. II., p. 229) also states that he had performed it with ease.

The projection made by the malleoli below the tibia, renders the cicatrix, it is asserted, incapable of sustaining the weight of the body after the cure. The deficiency also of soft parts in this place, and the numerous tendons that surround the articulation, diminishing the prospect of immediate reunion, gave room to apprehend accidents of the most serious nature. But are not most of these difficulties and dangers imaginary? What is certain is, as Brasdor had already remarked, that the projecting points of the malleoli soon become smoothed, (*s'émousser*,) and the whole extremity of the limb rounded, and that it is in our power to preserve a sufficient quantity of integument to cover a great portion of the wound. Theoretic objections, and one or even two facts, are not sufficient to decide a question of this kind definitely, and I am of opinion that if favorable circumstances presented, it would be allowable on this subject to make additional trials; so much the more so, since, according to M. Couprie, (*Thèse No. 110*, Paris, 1825,) there was an old soldier, familiarly known for a long time, who had undergone in the campaign of Russia the amputation in question, and who walked by means of a buskin. This buskin, designed by the patient, was constructed upon the same principle as that of M. Mille, of which we shall speak shortly. M. Lenoir, (*Thèse citée*, p. 30,) who dissected the limb in 1834, says that the amputation in this man's foot had not been regular, and that one of the malleoli was wanting; which adds a still greater interest to the result.

A. The operation in itself, moreover, would offer no difficulty. Two semilunar incisions, one over the instep, the other above the heel, at twelve to fifteen lines in front of and behind the articulation, and uniting so as to form another semilunar incision on each side, at about an inch below the malleoli, would constitute the first stage. After having drawn back the skin, we should divide as near as possible to the articulation, the extensor tendons of the toes and of the peronei muscles, that of the tibialis anticus, and those of the flexor muscles of the metatarsus, the tendo Achillis, the external lateral ligaments, the internal lateral, and the anterior and the posterior. The astragalus could then be separated without any effort from its fibulo-tibial (*péronéo-tibiale*) socket, (*mortaise* or *mortice*,) and removed with the rest of the foot. The hemostatic means having been applied, I should prefer bringing the lips of the

wound together from before backwards, in order that its angles might enclose the points of the malleoli. It is to attain this object that I recommend incising the integuments at some distance from the malleoli and articular indentations, (échancrures,) and not close to them as is advised by Brasdor and Sabatier.

B. If the flaps should be arranged as Rossi recommends, one upon the inside and the other upon the outside, the flaring (l'écartement) of the malleoli would render coaptation utterly impossible, and it would be absurd at the present day to endeavor to cut them out by passing a double ligature through the articulation, as this author professes to have done with success.

§ II.—*With the Astragalus alone.*

M. de Lignerolles has communicated to me an improvement which will probably cause this operation to be received in practice. By leaving the astragalus, and amputating only the os calcis with the foot, we should have, instead of the projections of the malleoli, a large and nearly flat (plane) surface at the extremity of the stump, and there is every reason to believe that a shoe or a buskin properly made, would find in this part a convenient point d'appui. In such cases, we should cut the flaps upon the sides, and raise them upon the malleoli, before proceeding to the disarticulation.

[AMPUTATION ABOVE THE ANKLE.]

THE SUPRA-MALLEOLAR (SUS-MALLEOLAIRE) AMPUTATION.—*The Process of M. Fl. Tavignot, by Antero-posterior Flaps.*—M. Fl. Tavignot, of Paris, as early as 1840, (*Gaz. Méd. de Paris*, 1840, No. 35,) proposed a new modification of flaps in amputating the leg above the ankle, especially in cases of severe inversion or twisting of the foot inwards, followed by inflammation of the tibio-tarsal articulation, necrosis, and ramollissement of the tarsus, fistulous abscesses, &c., as in children, who, it may be remarked, are predisposed to such contorsions from the pliant nature of the soft and hard parts, ligaments and aponeuroses, yielding readily to causes of displacement.

This method he conceives superior to that of Ravaton, (*Chirurgie de Ravaton*, t. III., p. 477,) by antero-external and postero-internal flaps, that of Salmi, of a single posterior flap, or the more ingenious modification of the ovalar flap by M. Lenoir, which is still, however, based on the principle of Salmi's process; because in these different modes there is still the greater or less tendency to eversion or rupture of the cicatrix, and especially to gangrene. That of Salmi is, he considers, particularly objectionable, because it requires so wide a flap, which is always to be avoided, if possible, and also because, to make such a flap, it becomes necessary, in order to cover the osseous surfaces completely, to perform the amputation higher up. Moreover, what is still more objectionable in Salmi's method, is, that it leaves a peripheric cicatrix, occupying the two anterior thirds of the limb; which occasions a disagree-

able traction and chafing in the stump during the movements of flexion and extension, in walking. M. Tavignot considers as equally unfavorable a cicatrix at the posterior part, and therefore does not concur with M. Malgaigne, who, (Vid. his *Manuel de Méd. Opér.*, 3d edit., p. 312,) in speaking of the preference which Prof. Velpeau gives to the posterior over a central cicatrix, considers it a matter of indifference.

In the process of Ravaton, he made his circular incision below the malleoli, whereas, M. Tavignot's transverse, curved incision does not go down so low as those prominences; besides, Ravaton's two lateral, perpendicular incisions were not exactly anterior and posterior, as he called them, but antero-external and postero-internal, thereby placing his cicatrix so much anteriorly as to be obnoxious to the same objections as those above mentioned.

The process of M. Tavignot, as afterwards improved by him, while Interne of the Hospital des Enfants Malades, (See his memoir, *Journ. des Connaiss. Méd.-Chir.*, Paris, Dec. 1841, p. 238, et seq.) is as follows:—Two vertical incisions, going through the skin only, the inner one parallel to the internal border of the tibia, the outer following the middle portion of the fibula, extend from a point twelve centimeters above the tibio-tarsal articulation to three centimeters from this articulation. These are united anteriorly by a transverse curved incision, with the convexity downwards, and the flap being rapidly dissected up to its base, the point of the knife is plunged transversely from within outwards, and slightly from above downwards, grazing the posterior part of the tibia and fibula, and the posterior flap then made, while drawing its middle portion upward so as to protect its lateral extremities, already divided in the cutaneous part, from the instrument. The extremity of this flap, which is to be properly rounded, reaches to about one centimeter from the insertion of the tendo Achillis into the os calcis. If the inter-osseous space is too narrow to be perforated, the difficulty is to be overcome by the point of the knife, if possible. M. Tavignot says his anterior flap is generally a third less than the posterior; but this difference is to be regulated by the age and other circumstances.

It could have been desired that this young surgeon had been more explicit as to the *section and separation of the bones*, as not one word is said, at least in this communication, (loc. cit., *Journal des Connaiss.*, &c., Dec., 1841,) on this subject. It will occur, however, to any one, that, previous to the tibio-tarsal disarticulation, a section must have been first made of the malleolar extremities of the fibula and tibia, by means of the saw, and at three centimeters or more above the articulation. The several cases which have been latterly operated upon, and all successfully, by M. Tavignot, have been children, in whom probably from the soft, gelatinous texture of their bones, the bone-nippers or scissors of Liston, might, in such subjects, have been conveniently substituted, making the process virtually the same, in this respect, as that of disarticulation or amputation of the joint, so zealously recommended,

and so successfully practised by M. Syme, of Edinburgh, (see *infra*.) whose improved and expeditious mode, nearer the ankle, and with a thick posterior flap from the sole of the foot, is, as we think, to be preferred to that of M. Taignot, except where the articulating extremities of the tibia and fibula are involved in degeneration which, however, was not the fact in any of the last cases operated upon by him, (*loc. cit.*, *Journ. des Connaiss.*, Dec. 1841.) M. Blandin had also obtained the most satisfactory results from amputation above the ankles, which he performed on a young girl in 1835, whom he exhibited to the Academy of Medicine of Paris, Nov. 9, 1841, with such admirable use of her limb, by means of M. Martin's apparatus, that she could walk with it as far as three leagues, go up and down stairs, &c., (*Journ. des Connaiss.*, Paris, Dec. 1841, p. 260.) We are gratified, in addition to what our author, M. Velpeau, has said upon the subject of supra-malleolar amputation at the ankle-joint in the text, to furnish an epitome of his more recent opinions touching the preference he entertains for that operation rather than amputation of the leg, at what is called the *place of election*. These opinions are, it may be said, neatly embodied in a report of the surgeon of La Charité, made by him as early as the sitting of the Academy of Medicine, of Paris, October 12, 1841, on a memoir addressed to the Academy by MM. Arnal & Martin, entitled: *De l'Amputation sus-malléolaire de la Jambe, comparée à l'Amputation au lieu d'Election*, (See *Journ. des Conn. Med-Chir.*, de Paris, Novembre, 1841, No. 5, p. 215-216.

The following, says M. Velpeau, are the propositions which these physicians establish in favor of supra-malleolar amputation:—

1. It may be performed with more promptitude and facility than the ordinary operation;
2. It causes less pain;
3. It is less frequently accompanied with gangrene of the flap, so common in the ordinary method;
4. It exposes to less risk of secondary hemorrhages;
5. The traumatic fever which it causes is milder and less violent;
6. The cicatrization is more rapid;
7. In consequence of the rapid cure of the wound made by the amputation, it is less liable to be attacked with hospital gangrene;
8. The accident of *conicity* of the stump follows it less frequently;
9. The patients are less frequently attacked with purulent absorption;
10. In conclusion, the patient, after the cure, is less exposed to the accidents of general plethora, and can make a more free use of his limb.

MM. Arnal and Martin had obtained from the practice of twenty-five surgeons a collection of *ninety-seven* cases of supra-malleolar amputation, of every diversity of condition, as respects sex, age, disease and country. Out of these ninety-seven cases, there were *eighty-seven of complete cure*, that is, the proportion of the cures to the deaths is as nine to one; while Dupuytren admits, that in amputation at the place of election, one dies out of every four cases.

Considering all the above propositions separately, M. Velpeau comes to the following conclusions :

1. Supra-malleolar amputation is manifestly less dangerous than that which is practised at the place of election.
2. It is practicable to adapt to the limbs which have undergone this operation, prothetic (i. e., substitute) means which allow of walking and of concealing the deformity.
3. The artificial limb which possesses the most advantages is that which has been devised and constructed by M. Martin.
4. By means of this artificial leg a patient is enabled to walk, sit down, get up, ascend and descend a stairs, in a word to execute all the movements required in the occupations of social life.
5. In those who have it not in their power to procure such a substitute, the question still arises, whether supra-malleolar amputation ought to be preferred to the other.
6. It would be a discovery of the highest interest to find a cheap substitute which would fulfil all the conditions required to allow of the movements of the limb.

M. Gimelle stated that after the return of the French army from Russia, about thirty to forty patients who had been amputated above the ankle, were received into the Invalides, and that out of this number such was the inconvenience of the stump, that twenty-one or twenty-two submitted to the amputation at the place of election. As a further argument in favor of the latter operation, M. Gimelle remarked that M. Pasquier at the Invalides had not lost a single case out of *thirty-four amputations* at the place of election.

M. Larrey at the same sitting of the Academy maintained that in those operations he cured eight or nine out of ten ; and had, before M. Pasquier, obtained nineteen successful results by this mode of operation ; that when on the contrary we amputate near the malleoli, we cannot look for reunion by the first intention ; for it is necessary before the wound can close that the osseous extremities should become smoothed away (*s'usent*) and rounded off, which necessarily requires a very long time.

M. Velpeau replied : It is well ascertained at the present time that in amputation at the place of election, the proportion of deaths is as one to four or five ; while in supra-malleolar amputation it is about *one in ten*. This then is one great advantage ; for it is something, according to my ideas, to lose *one-half* less of our patients. I can state that the five persons on whom I have performed this operation, have recovered the use of their limb to such extent, that it is scarcely possible to imagine that they had undergone an operation. A lady upon whom I performed it lately met me in the street, says M. Velpeau, and I could scarcely recognize her, for nothing in her step differed from that of other persons. She has been enabled this winter to attend balls and to dance. I don't pretend to say, continued the Professor, that she has made any extraordinary *pas*, (*entrechats*.) but she has certainly engaged in many country dances. The thanks of the Academy were returned to the authors of the memoir, and it was sent to the committee of publi-

cation: the Academy, so far at least, expressing their concurrence with MM. Arnal, Martin and Velpeau.

PROCESS OF M. SYME.

Mr. Syme (Cormack's *Lond. and Edinb. Month. Jour. of Med. Sc.*, Feb., 1843, p. 93, &c.) in cases where Chopart's operation cannot be performed on the tarsus, gives a decided preference to amputating at, in other words disarticulating, the ankle joint, and this also on every occasion where, according to old usages, the leg would have been taken off below the knee. To make a better and rounder stump he usually excises the malleoli with a cutting pliers. The plantar flap is made by a transverse incision through the middle of the tissues of the foot, meeting the corresponding dorsal incision directly over and in a line with it, except that the latter has a convexity given to it forward. The thickness of the tissues about the os calcis form a firm support, and the whole contour of the stump is exceedingly well adapted to an artificial apparatus with hinges, straps, &c., to supply the form and motions of the foot.

This operation becomes necessary also (*loc. cit.*) where caries affects the astragalus or os calcis, or as very frequently happens, is seated in the articular surface between these bones for partial amputation there can be of no avail. Also more especially in those cases of compound dislocation of the astragalus and caries of this bone, with its adjoining articulating surfaces, and for which hitherto amputation of the leg above the ankle had been deemed necessary.

It may be objected, continues Mr. Syme, who has paid great attention to this subject, that when the joint itself is diseased, entire removal of the articulation must be requisite. But, says this surgeon, in what is commonly called disease of the ankle, the joint between the astragalus and os calcis is affected much more frequently than that between the astragalus and bones of the leg; and even where the latter condition really exists, it would be easy to remove all of the bone that is essential for recovery, by sawing off a slice from the articulating extremities of the tibia and fibula, as the caries penetrates to no great depth in the cancellated texture. The advantages at the ankle over that at the knee he considers to be, 1st, The risk of life is smaller; 2d, A more comfortable stump will be afforded; 3d, The limb will be more seemly and useful for support and progressive motion.

The risk of life is less because the parts removed are not so extensive, being but little more than by Chopart's operation; there is less also to fear from hemorrhage immediate or secondary, because the vessels are less and merely branches of the posterior tibial artery and of the anterior tibial near its termination; and the cavities of cylindrical bones not being opened, there is no danger of exfoliation from the dense osseous texture, and inflammation in the medullary veins. (See a case of medullary suppuration in the tibia below.)

The stump too is more comfortable, because it is formed of parts

peculiarly well calculated to protect the bone from injury, and not disposed to contract like the muscular tissue; the nerves also being smaller here, their cut extremities will be less apt to enlarge and become the seat of uneasy sensations, while the absence of exfoliation ensures complete union of the integuments over the bones. And the limb will be more useful and seemly from full play being afforded to the movements of the knee joint, without the embarrassment of an imperfect stump.

Mr. Syme therefore strongly advocates amputation at the ankle joint, as an operation that can be advantageously introduced [revived or generalized he should have said, as it will be seen by the text *supra* and *infra*, and the notes above, that it has been long known. T.] into surgery; and regrets having cut off many limbs that might have been saved by it, (*Loc. cit.*, p. 95-96.)

This surgeon, since the period at which the above memoir was published, has continued to practise this amputation with we believe unvarying success, and by a later communication from that surgeon to the same journal, (Cormack, Aug., 1844, p. 647, &c.) we are informed that he is more and more satisfied with the decided preference which ought to be given to it, and is happy to find that this method is rapidly gaining ground. He does not, he says, pretend to claim to be the author of it, as it had been performed on the continent he assures us by different surgeons, long before he thought of it. Mr. Syme, however, is we believe fully entitled to the merit of having practised it more frequently than any other person, and as a natural consequence of this, of having made such improvements in the manipulating process, as to have given greater assurance of a successful result where his mode has been adopted. He also intimates in the communication last referred to, that his greater familiarity with the operation at present has enabled him to rectify an error that he labored under at the time he published his first cases.

The best instrument, he says, is a large bistoury or small amputating knife with a blade about four inches long. The grasping of the ankle by an assistant renders a tourniquet entirely unnecessary. In his first operations, he says, his flap was made unnecessarily long. Both incisions should, as before said, be continuous, and exactly opposite to each other, and both of them convex forwards, each convexity reaching to a line drawn round the foot midway between the head of the fifth metatarsal bone, and the malleolus externus; and they should meet a little way farther back, opposite the malleolar projections of the tibia and fibula. Care should, he remarks, be taken to avoid cutting the posterior tibial artery, before it divides into the plantar branches, as in two cases where he did so there was partial sloughing of the flap. These branches nourish the flap, and must be left intact. If the ankle joint is sound the malleolar processes should be removed by cutting pliers; but if the articulating surfaces of the tibia and fibula be diseased, a thin slice of these bones should be sawed off. The edges of the wound should be stitched together and lightly dressed.

Until a recent period, this surgeon says, the leg was generally am-

puted wherever the disease of the bone extended upwards beyond the metatarsus. In 1829 this surgeon ventured (*Edinb. Medical and Surgical Journal*, Oct., 1829) to adopt Chopart's process in a case of this description where amputation of the leg had been proposed. His success was complete in this and five other similar cases; since when the operation he considers to have been firmly established in Edinburgh.

But Chopart's process cannot reach cases where the caries is between the astragalus and os calcis, or in the ankle joint itself. In the former situations the gouge cannot be depended upon, but in one case Mr. Syme succeeded by making a breach through this part of the foot, and inserting a seton besmeared with escharotics as red precipitate, &c. But he would rely only on the operation. Formerly, too, the leg was amputated in those complicated dislocations of the ankle joint where the astragalus is displaced from falling with great force on the heel; afterwards the practice was to save the limb, but this is a tedious and dangerous process, as Mr. Syme thinks; for out of 13 such cases at the Royal Infirmary, Edinburgh, only *two* recovered of those not amputated; besides which the foot remains stiff, sensitive, and in fact an incumbrance. For all which reasons he advocates amputation at the joint in such cases. (See Mr. Hancock on this subject below.)

Mr. Syme gives, in addition to the six successful cases in which he had already performed this amputation, four others, which make *ten* in all. He considers that there are, in reality, but very few occasions in which it can be necessary to amputate the leg itself above the ankle; having done so himself, viz., below the knee, in only one instance since he adopted the operation at the ankle—this last method being in this one exception inapplicable, from the peculiar circumstances under which the patient was placed.

In fact, malignant tumors of the tibia and fibula require, says Mr. Syme, amputation of the thigh; and compound fractures of the leg, so severe as to demand removal of the limb, hardly admit of the operation being performed below the knee, on account of the soft parts so near the seat of the injury being unfit for the healing action.

The advantages at the ankle (to recapitulate) are, in conclusion: 1st, That there is less mutilation; 2d, Greater utility of the limb; 3d, Much less danger than in amputation of the leg, because the shock must be much less, from the small extent of soft parts removed, being little more than in Chopart's partial section of the foot; because, also, the smallness of the arteries divided presents no risk of serious hemorrhage, while the cancellated texture of the bone exposed is not liable to exfoliate, and the medullary canal remaining entire, inflammation of its contents and also of the veins is prevented.

In a case related by Mr. Lyon, of Glasgow, (*London Medical Gazette*, May 31, 1844, p. 302,) which commenced with osteitis of the tarsal and metatarsal bones, and in seven months ended in ca-

ries, leaving the os calcis and astragalus still unaffected, he proposed Chopart's operation, which being declined, and these bones in another month becoming also involved, he now was induced, as the only resort, to recommend the process of supra-malleolar disarticulation, so strongly recommended and so successfully performed by Mr. Syme, of Edinburgh, according to the useful modifications which the latter surgeon has given to it. This proposal was agreed to. Mr. Lyon was not deterred from proceeding, though the malleolar processes were soft—a condition common in strumous subjects. He made an opening at the most dependent part of the posterior flap, as a *safety-valve* for any pus that might collect, as recommended by Mr. Syme. A finger's breadth of the anterior flap mortified on the fifth or sixth day and separated, when granulations soon after agglutinated the cellular surface of the flap to the synovial membrane.

Mr. Lyon thinks he erred in applying cold lotions to the wound, as it may diminish too much the vitality of the flap, [the anterior flap, no doubt. T.] which being composed only of skin and cellular membrane, and but loosely connected with the adherent parts, (as in circular amputations,) may, if treated thus, be more disposed to gangrene. Carded cotton and applications of warm water are preferable. The same tendency to gangrene exists in the posterior flap in this method of Mr. Syme, as it is large and thick, and the condensed cellular substance and thick cutis of which it is composed is but poorly supplied with blood, viz., only from the vessels that pass through the skin and cellular substance of the posterior and inferior part of the leg; hence the circulation in these small vessels is weak, and liable to interruption.

To meet these objections, Mr. Lyon properly recommends that the margins of the two flaps should be carefully placed in *close and easy contact*, in order that primitive union may take place, and the blood pass from the anterior into the posterior flap, and thus prevent gangrene; which is the more necessary, since immediate union between the synovial membrane covering the cartilage and the condensed cellular membrane lining the flap is not to be expected. We should, therefore, be careful to employ sutures and plasters, and avoid pressure, compresses, and bandages. Interrupted sutures and short strips of plaster to approximate the lips are eminently serviceable.

M. Stanski, in all cases, prefers the supra-malleolar method to Chopart's operation. He relates an interesting case, (*Gaz. Méd. de Paris*, t. XII., 1844, p. 528–529,) to illustrate this, of a woman aged forty-seven, who, from spraining the left ankle, was attacked with inflammation in the part, which was followed by a large number of fistulous openings about the joint, discharging pus in such quantities as to bring on symptoms of phthisis. The foot was amputated on Chopart's principle, but the retraction was so great backwards, that the cicatrix was drawn underneath, giving pain on walking, and again became a running sore. M. Stanski now amputated the limb above the ankle, and effected a perfect cure. The

reasons why, in his opinion, this operation should always be substituted for Chopart's, appear quite conclusive. The examination of the amputated foot shows us, says M. Stanski, that Chopart's amputation, far from presenting an advantage to the patient, is rather injurious; for, in this operation, the bones of the tarsus being disarticulated almost on the line with the anterior border of the articular pulley formed by the tibia and fibula, the tendons of the anterior muscles of the leg, in supposing even that they took their point of attachment on the astragalus, act on an arm or lever so short, as, compared with that on which the muscles of the posterior region of the leg exercise their action, that they cannot, in any manner, counterbalance the power of these last; and if they are inserted ever so little on the skin, as occurred in the case in question, their action is lost as to the movements of the foot, while the tendons of the posterior muscles, attaching themselves to the lower surface (face) and posterior extremity of the os calcis, preserve all their action. It results from this, that the fibres of these muscles, in retracting, draw up the heel forcibly backwards, and favor, by that, the retraction of the ligaments and aponeurotic fibres which are found behind the tibio-tarsal articulation, and finally draw the cicatrix of the stump downwards—an inconvenience which prevents the patient from resting on his foot, and which cannot be essentially remedied by any mechanical shoe, nor by the section of the tendo Achillis, as was proved also in this case. The greatest obstacle to putting the foot down, however, was the strong retraction of the posterior fibres of the external lateral ligament, which thus kept the foot in permanent extension. Therefore, to bring the foot down to its place, it would have been necessary not only to make the section of the tendons of all the muscles of the posterior region of the leg, but also, and perhaps principally, of the posterior fibres of the external lateral ligament, in order to replace the astragalus back into the articular pulley of the tibia and fibula, from which it had become evulsed, and to keep it there in spite of its powerful tendency to escape from its position.

M. Lucien Boyer exhibited very recently, to the Academy of Medicine of Paris, May 20, 1845, (see *Gaz. Méd.*, Mai 24, 1845, p. 332,) a striking illustration of the advantages of the new apparatus of M. Martin, so much extolled by M. Velpeau, (see *supra*,) which is adapted to the leg in amputation at or above the malleoli. The case exhibited was a young boy, aged ten or twelve, upon whom M. Boyer had performed this operation, and who, with the aid of M. Martin's apparatus, could walk, run, leap, and make every kind of evolution, almost with as much facility as if he had had a natural limb. T.]

ARTICLE VIII.—AMPUTATION OF THE LEG.

Though amputation of the leg is now less frequently performed than formerly, it is often rendered indispensable, from diseases of the tibio-tarsal articulation, complicated fractures, wounds from fire-arms, gangrene, &c.

§ I.—*In the Continuity.*

The rule which advises that we should amputate as far from the trunk as possible, has been but rarely applied to the leg. The point selected for the division of the bones, even in cases where the disease has not extended above the lower articulation, is at two or three fingers' breadth from the tuberosity of the tibia. The tendinous expansion of the sartorius, gracilis, (grêle interne,) and semitendinosus muscles, is by this means preserved. The stump not only possesses flexion and extension, but is of sufficient length to enable the knee to rest firmly and without any inconvenience upon an artificial leg. It is easy, also, to obtain a sufficiency of soft parts to cover the wound. We may, nevertheless, when the disease does not extend above the tibio-tarsal articulation, amputate the leg either in its lower or upper third.

A. *Amputation at the Lower Third.*—As we approach the malleoli, we ultimately meet with nothing but integuments, (la peau.) The cicatrix is formed with difficulty, continues in a state of tension, and is easily ruptured. After the cure, the stump being too projecting behind, is constantly exposed to strike against external objects, and thus becomes more annoying than useful; to such a degree, in fact, that many persons operated upon in this manner, have themselves requested a second amputation, of which cases Sabatier gives examples, and which had already been previously noticed by Paré, (*Œuvr. Compl.*, liv. XII., ch. 29, p. 358) Higher up, the saw traverses the tibia in its spongy and thickest portion. The fibrous expansion, known under the name of the pes anserinus, (patte d'oie,) [see a note on this, Vol. I.,] might be wounded, which would impair the action of certain muscles of the thigh upon the stump. Such, at least, are the arguments which for a long time past have been adduced in support of the precept which has just been given. Nevertheless, V. Solingen (*Man. des Opér. de Chir.*, p. 240) has vigorously opposed this doctrine. According to him, we should amputate the leg like the fore-arm, as low down as possible. By employing a shoe, supported by two thin and polished blades of steel, which are fixed upon the sides of the leg by means of cogs (engrénures) properly adjusted, patients walk almost with as much facility as with their natural foot. Many foreign surgeons at that epoch concurred with him in opinion, nor did Dionis (*Démonstr. des Opér. &c.*, p. 742, 9e dén.) differ widely from him. However, there was no longer any discussion upon this process, when Ravaton, (*Journal de Vandermonde*, t. V.,) White, (*Cases in Surgery*, 1770,) and Bromfield, (*Obs. and Cases*, &c., 1773,) about the middle of the last century, imagined that they had discovered it. Like Solingen, these authors extolled the employment of machines, those among others of Wilson, (Rossi, *Méd. Opér.*, t. VI., p. 219,) designed to admit of flexion and extension of the leg, and of walking, in fact, in the same way, as with the natural limb. Ravaton's buskin, (bottine,) secured by means of leather straps,

(courroies,) left a slight void under the point corresponding to the cicatrix, in order to avoid compression upon it. But Sabatier objects, with reason, to this mode, because the weight of the body must thereby force the integuments upon the extremity of the stump to mount upwards, and thus continually make tractions upon the cicatrix until it is torn. M. Larrey expresses the same opinion of it. Vacca, (Salemi, *Mém. sur l'Amput.*, etc., 1829,) Brunninghausen, (Soulera, *Thèse*, t. XIX., 2e partie, Strasbourg, 1814,) and M. Soulera, (Soulera, *Thèse*, Strasb., 1814,) have, notwithstanding, ventured in our days to revive this practice. Rossi, also, (*Méd. Opérat.*, t. II., p. 205-219,) in his book, on two different occasions, does not hesitate to recommend it. Lucas and Alanson, (*Man. de l'Amput.*, trad. par Lassus,) in imitation of White and Bromfield, also amputated the leg in its lower third, which amputation is likewise recommended by Platner, Delaroche, (*Encyclop. Méth.*, part. Chir., t. I., p. 99,) and by Benjamin and Charles Bell, (*System of Operative Surgery*, 1807,) and was performed by Wright in three cases.

I. It must be confessed that *amputation* of the leg in its lower portion, is, from the small quantity of soft parts found there, a much less serious operation than in the place of election. The teguments that may be preserved, suffice for reunion, even by the first intention.

We cannot assert that it is impossible to construct machines of a sufficient degree of perfection to simulate the portion of the limb destroyed, and to allow of walking, in such manner as to render the deformity almost imperceptible. Solingen, White, Ravaton, Bell, Bromfield, and many other German surgeons, relate facts which prove the contrary. Because some patients have done badly under this operation, it by no means follows that it is to be rejected for all the others. Success in such cases must depend upon many circumstances, which, in my opinion, have not been sufficiently weighed. The cicatrix may be more or less firm, or it may be placed at the centre or at the circumference of the stump. Though it may be true that buskins have not yet received all the perfection desirable, it does not follow that human art may not attain this point. The two patients thus operated upon who have fallen under my observation, are enabled to walk by means of so imperfect a buskin, that it is difficult for me to conceive of the absolute necessity of making use of the knee as a point d'appui for an artificial limb. I come to the conclusion, therefore, that in persons who are not obliged to make long and fatiguing marches, and who attach much importance to the natural form of the leg, or to the appearances of a natural conformation, amputation by the method of Solingen, might occasionally be adopted. There would be an advantage, as I conceive, in such cases, to divide the integuments in such manner that the cicatrix might be thrown behind, and not upon the central part of the stump.

Since the year 1831, the epoch at which I held this language, amputation at the lower third of the leg has been reintroduced in prac-

tice. M. Keate, (Lenoir, *Thèse de Conc.*, 1835, p. 24,) of London, has declared himself an advocate for it on certain occasions; M. Ribéri, who treats of it at great length in his work on amputations, states that he has performed it five times with success. Public attention has been again awakened upon this subject, by more ingenious and perfect machines, first by M. Mille, (*Journ. Hebd.*, 1835, t. II., p. 161,) and then by M. Martin, (*Bulletin de l'Acad. Royale de Méd.*, t. I. et II., 1837,) than the buskins that were first in use. M. Goyrand, (*Journ. Hebd.*, 1835, t. II., p. 261,) at Aix, has performed it four times, and been well satisfied it. I was the first that had recourse to it at Paris, (Dufresne, *Journ. Hebd.*, 1835, t. IV., p. 129,) viz., in June, 1835, in a patient who had had his foot crushed, and who recovered. M. Roux, (Garavel, *Thèse No. 331*, Paris, 1837,) M. Blandin, (*Ibid.*,) and M. Serre, (*Compte-Rendu de la Clin. de Montpellier*, 1837,) also soon after employed it. These new facts, moreover, are in accordance with the judgment I have given above. I exhibited at the Hospital of La Charité, a young girl operated upon by M. Blandin, and who, by means of M. Martin's buskin, walked with great freedom, ascended and descended the stairs without trouble, and could leap upon a chair, so as, in fact, to completely mask her mutilation in the eyes of the spectators. Nevertheless, this apparatus is still too complicated, is too much in need of the supervision of a skilful mechanist, and is too dear to be attainable by most persons. Where this is to be used, I should recommend amputations at the lower third of the leg, in those only who live in cities, or are in easy circumstances. Working people, and those who have to perform severe labors, and who, the greater part of the day, have to be on their feet, or walking, are more at their ease, and more secure with the old drum-stick (pilon) under the knee, than with the buskins of MM. Mille and Martin.

II. *Operative Process*.—Many processes have been employed in amputation of the leg at its lower third.

a. *Various Processes*.—M. Salemi recommends that we should cut the flap behind, and of sufficient size to cover the wound. M. Robert, (Bérard, *Dict. de Méd.*, 2e édit. t. XVII., p. 260,) by this mode, cured his patient in thirty days. After having divided the skin circularly, M. Blandin, (Garavel, *Thèse No. 331*, Paris, 1837,) made a longitudinal incision in front and behind, in order to have a flap on each side. Others, as M. Lenoir for example, have proposed, after having divided the integuments by the circular method, to raise them up in front like a ruff, to the extent of an inch, and to confine ourselves to the division of their connections (brides) in proportion as they are drawn back. The facts are not yet sufficiently numerous to enable us to appreciate the relative value of these different processes. That of M. Blandin originates from the process of M. Larrey, and that of M. Lenoir from the process of Sabatier for amputation of the leg at the place of election, and neither have any greater or less value above the malleoli than below the knee.

b. *Process of the Author*.—An assistant compresses the artery at

the pubis, or applies the tourniquet at the lower third of the thigh. A second assistant supports the foot, while a third seizes the leg, and prepares to raise up the integuments.

The surgeon, placed indifferently either upon the outside or the inside, circularly divides the skin as near as possible to the base of the malleoli, and raises it in the manner of a ruff, to the extent of an inch and a half in front, and an inch only behind. He then proceeds to the section of the tendo Achillis, and then to that of the anterior and lateral tendons, at the base of the cutaneous fold.

The inter-osseal knife is generally not required, since at this point the two bones are separated only a few lines apart. It is with the point of the bistoury, therefore, that we complete the division of the soft parts. If the split compress [the retractor] is used, it should have but two tails, and should be made to embrace the limb obliquely from without inwards. The section of the bones has nothing peculiar, except that it is almost useless to remove the upper angle or inner border of the tibia, as is sometimes done at the upper third.

The only arteries that require the ligature or torsion, are the anterior and posterior tibial and the fibular. The integuments being now brought down, are united together from before backwards and from without inwards. In the bed the stump is kept extended or moderately flexed upon a large cushion. The consequences are nearly the same as in the upper third of the limb, except that the reaction here is less, and the cure generally more prompt. [See more fully on this subject, in the notes immediately preceding, on supra-malleolar amputation. Our author's views, it will be seen, correspond in the main with the more modern improvements since introduced by Mr. Syme and others. T.]

B. *Amputation at the Upper Third.*—Some persons have placed the *point of election* (vid. supra) either higher up or lower down than I have given it above. Hey, for example, fixes it at the middle of the limb. M. Garigue, (*Thèse*, Strasbourg, 1836,) on the contrary, proposes, as De la Motte (*Traité de Chir.*, t. II., p. 334, Obs. 313, edit. Sabatier) and Bromfield had advised before him, that we should amputate much nearer the articulation, and even above the tuberosity of the tibia. M. Larrey (*Clin. Chir.*, t. III., p. 557) strongly advocates this plan, which M. Guthrie (*On Gun-shot Wounds*, 1815) also formally approves of, and which Percy and Malvini, it is said, (*Mém. de l'Acad. Royale de Med.*, t. II., p. 12) were the first to recommend.

I. The point where these surgeons amputate, however, should be considered rather one of *necessity* than of *election*. Viewed in this light, I agree with them in opinion. If it were not advisable to amputate at the knee, I should always prefer amputation of the leg, if it were only at an inch below the articulation, rather than amputation of the thigh. I am even of opinion that it would be better, as a general rule, to make the section of the bones immediately below the tuberosity of the tibia, than at the place where it is usually preferred. The section of the tendons of the sartorius,

the gracilis, (grêle interne,) semi-tendinosus, and ligamentum patellæ would not prevent these organs, in the end, from retaining their action on the upper extremity of the leg. In this part there is no longer any inter-osseal space. The popliteal artery is the only one which has to be tied; or, at least, there are no others but the fibular and the posterior tibial which may properly require this assistance. The head of the fibula may be removed. The amputation of the leg then resembles that of the limbs where there is but a single bone. The spongy state of the tibia, far from being an inconvenience, presents, on the contrary, the advantage of rendering the development of the cellular granulations (bourgeons) more easy and more prompt. It must, however, be admitted that integuments only are found in the anterior half of the circumference of the leg at this place, while, farther down, the muscular tissues come to their assistance; but, as it is the integuments definitively which always shut up the wound, I cannot see what great evil can result from it. In conclusion, did not the spongy substance of the tibia, in contact with the pus, expose to phlebitis and to the resorption of morbid matters; and did we not, in operating above the head of the fibula, run the risk of opening into the synovial membrane of the knee joint, which membrane is sometimes prolonged as far down as that point, of which M. A. Bérard has communicated to me two examples, of which I myself have now seen a number of instances, and which M. Lenoir (*Thèse de Concours*, etc., 1835, p. 7) has noticed in twenty-four subjects, I would, without hesitation, adopt the method of MM. Garigue and Larrey.

In order, when the disease is very near the knee, to preserve the inferior attachment of the ligamentum patellæ, and to leave intact the mucous bursa which is found behind it, M. Larrey proposes moreover that we should direct the saw more or less obliquely from below upwards, and from before backwards. We may in this manner remove all the fibula and leave a small portion of the tibia which will prove equally useful as a point d'appui to the artificial leg; but in such cases the better practice appears to be to amputate at the joint.

II. *Anatomy*.—After the details above there can be no necessity of giving a long description of the leg. The tibia being thicker than the fibula, and situated on a much more elevated plane is the reason why the greater thickness of the leg is in the direction from within outwards and from before backwards, instead of being transverse. Its inner side being entirely unprovided with muscles, cannot after amputation, whether by the circular or flap method, be covered except by the integuments. Its sharp edge which forms a sort of crest in front, usually gives to its section in this part a very acute point, which may perforate the skin, if it is not attended to. In the lower part of the calf the conical form of the limb gives to the integuments when cut circularly too narrow an opening to be easily raised up, while above, this opening represents rather the mouth of a funnel. The tibialis anticus muscle, the extensors of the toes and the peroneus tertius, which fill up the outer inter-osseal fossa,

and adhere almost to the whole extent of this cavity, are incapable when divided of retracting beyond a few lines. It is the same with the peroneus longus and brevis muscles, and with the deep muscular layer, or the tibialis (posticus) and flexors of the toes which fill up the posterior inter-osseous fossa; while the gastrocnemii and even the soleus, should we amputate very low down, might retract considerably. The anterior tibial artery bending at a right angle at the moment it arrives upon the front part of the inter-osseous ligament, soon also associates itself with the nerve of the same name. The posterior tibial and peroneal arteries which separate sometimes lower down and sometimes higher up from the peroneo-tibial (poplitée) are almost always met with,—the first behind the external border of the tibia upon the posterior surface of the flexor longus digitorum pedis and tibialis posticus muscles, the second behind the fibula, (le péroné,) in the midst of the fibres of the flexor longus pollicis pedis. M. Lenoir, (*Thèse citée*, p. 8,) who maintains that the nourishing artery enters into its groove at two inches and a half, and into its canal, which itself is generally an inch long, at two inches and a half or three inches and a quarter below the tuberosity of the tibia, proves by that fact, in corroborating the assertion of Decourcelles, (*Manuel des Opérat.*, etc., p. 387,) that this artery is divided in the thickness of the bone, even when we amputate at the place of election, and outside of the tibia when we amputate a little higher up; and also that we are certain to avoid it by following the rule of M. Larrey. Moreover the nerve is almost constantly found situated upon the fibular side of the tibial artery.

III.—*The Operation.*—The leg may be amputated either by the circular or flap method.

a. Circular Method.—I. *Process of the Author.*—The patient, being placed upon a bed or operating table, is to be supported there in a proper manner.

First Stage.—To guard against hemorrhage compression is to be made on the femoral artery, on the body of the pubis, or against the inner side of the femur on a line with the little trochanter, or finally by means of a tourniquet or garrot. The garrot or tourniquet is to be preferred when there are not a sufficient number of assistants, or when we cannot rely entirely upon them. These instruments are applied upon the thigh with so much the greater advantage, inasmuch as they cannot in any manner interfere with the surgeon while he is amputating the leg, and that they serve also to diminish the pain and benumb the limb.

The operator ordinarily places himself on the *inside*; this is a general rule which has been long established. The reason given for it is, that it is more easy in this manner to complete the section of the fibula before we have got through the tibia, than if we were placed on the outside. Ledran, however, has remarked that the surgeon may dispense with this rule without danger, and even perhaps with some advantage. Gracfe and M. S. Cooper, on the other hand, maintain that it is full as advantageous to be placed always on the outside, or that it is at least not necessary to be on the inside

for amputation of the right leg. If, in fact, when on the inside and operating on the left leg, the corresponding hand being towards the upper part of the limb, is enabled to raise up the integuments in proportion as the right hand divides them; this cannot be done upon the right leg if we follow the rule laid down. Consequently the precept which it would be proper to substitute for the ancient one, and which I have myself conformed to for a long time past, is this:—*The operator is to place himself in such manner that the left hand may always grasp the leg on the side towards the knee*, unless however he should be ambidexter; in fact in this last case there would no longer be any more necessity for his placing himself between the two limbs than upon the outside of either. It would, moreover, be puerile for the surgeon to place himself outside, for the division of the soft parts, and then within when the bones only remain to be divided, as some English and German surgeons have recommended. Still more out of character (bizarre) would it be to leave the sound leg between the operator and the one to be amputated, in order never to place himself between these parts. The foot being wrapped in a fold of linen, is with the entire diseased portion of the leg confided to the last assistant.

Second Stage.—The operator, provided with an amputating knife, cuts circularly through the whole thickness of the skin, commencing at the crest and finishing at the inner border of the tibia; he then, by means of a second cut, unites the two extremities of this incision on the inner face of the bone, unless by a movement of rotation of the hand upon the handle of the instrument, and which I have already described, he should prefer passing round, without stopping, the whole circumference of the limb. Drawing back with his left hand the integuments thus divided, he detaches their cellular bridges, and raises them an inch or an inch and a half, or with the thumb and forefinger he seizes them by the upper lip of the wound, near the fibula. Then he dissects them with free strokes by means of the point of a knife or a bistoury, and promptly reverses them from below upwards, in order to form a sort of border or ruff.

Third Stage.—Having brought back the knife to the base of this cutaneous ruff or circle and to the same point on the tibia, the operator incises from before backwards, and from within outwards, so as to divide the aponeurosis and all the muscular fibres which rise above the level of (dépassent) the anterior inter-osseous fossa. Depressing the wrist, he divides in the same manner the peronei muscles, and then in gradually bringing the knife inwards, those of the calf or posterior surface of the leg, and again brings the instrument in front and detaches the aponeurosis on each side; then immediately applies its heel on the outer surface of the fibula and proceeds to cut from the handle to the point. When the point arrives upon the inner side of this last bone, we cut through the inter-osseous space, in order to divide all the deep-seated fibres, and while withdrawing the instrument to divide those also on the outer surface of the tibia. Replacing the knife below the limb and upon the same point of the fibula, the operator now again brings it back upon the

posterior surface of this bone; again traverses the inter-osseous space, and comes out from it in the same manner as in front; divides all the remaining muscles behind the tibia, and finds that he has described in this manner a perfect figure of 8, as has been said in speaking of amputation of the fore-arm. It is advisable, as in this last-mentioned member, to make a second cut with the bistoury on each border of the inter-osseous membrane. We then pass from behind forward and between the bones, the middle tail of the compress split into three tails; the different parts of which properly unrolled and then united are confided to the assistant who is charged with holding back the muscular tissues.

Fourth Stage.—The surgeon fixes the nail of his thumb at the spot where the tibia has been denuded, and applies the saw to this point, making at first only small cuts. He then elevates his wrist so as to complete the section of the fibula first, finishing with that of the bone upon which he commenced; since the fibula if alone would not present sufficient resistance to the action of the saw, and would also have its upper articulation exposed to a severe concussion, (*ébranlement*.) This last reason I think is far from conclusive, but the first is sufficient to justify the precept. As soon as the section of the fibula is completed, the assistant, who holds the lower part of the leg and the operator who embraces with his left hand the upper part, should take care to compress this bone with such firmness that it can no longer be shaken by the movement of the instrument. M. Roux advises to saw it higher up than the tibia: for which reason he inclines the saw obliquely upwards and outwards. By this mode of procedure M. Roux thinks he places himself more securely on his guard against the subsequent protrusion of the fibula. This is a matter of little importance, and the section of the two bones on the same line is full as good. Much less can I understand why some in imitation of certain practitioners should recommend their section separately. In fact, to render the section of the fibula more easy, if the surgeon were placed on the out instead of the inside, all that would be necessary would be, after tracing out a groove of proper depth on the principal bone, (tibia,) to have the aids turn the leg into pronation and to make a slight depression of the wrist.

V. Fifth Stage. The anterior angle of the tibia, upon which the skin is supported, and against which it is pressed by the weight of the muscles of the calf, which tend to drag it backwards after the dressing, sometimes causes perforation of the tegumentary coverings. Surgeons have early thought of the means by which such a difficulty might be prevented, and which is ordinarily avoided when amputation is performed very high up on the limb. I have seen MM. Richerand and Cloquet, at the Hospital of St. Louis, obviate it when it threatened, by applying a piece of pasteboard in the form of a splint to the posterior surface of the stump. A much surer method consists in removing with a cut of the saw the corner of the angle or the osseous border itself. It is not known to whom belongs the first suggestion of this improvement, unless it be to

Assalini, who I believe first speaks of it in his *Manual of Surgery*. Military surgeons have been for a long time in the habit of practising it. It was pointed out in the beginning of this century by an army surgeon, whose name has escaped me. M. Marjolin also, and Bécларd, in teaching it in their lectures, have caused its adoption among French surgeons. MM. Guthrie, S. Cooper, and other English practitioners, have also long since made mention of it, without however appearing to accord to it any very great importance. In place of the anterior angle it is the inner border, it is said, that M. Sanson saws off, but there can be no fixed rule in this matter. Whether it is the border or the angle, what to do is to remove the salient point, and that constitutes the whole affair. I have often adopted and often omitted it, and have noticed that it was only really necessary in thin persons with flabby integuments, and when we amputate rather low down. Perhaps in such cases it might be advisable to follow the plan of M. V. Onsenort, who before rounding off the cut surface of the tibia dissects a flap from the periosteum, with which he covers the end of the bone.

2. *Process of Sabatier*. The process of M. Sabatier only differs from the preceding in this, that this author prefers incising in the first place the integuments upon the anterior half of the limb, and that we should draw them back before continuing the circular incision a little higher up behind. His reason is, that on the calf the skin retracts with the muscles, while in front of the tibia and of the anterior aponeurosis it will go up no higher than it is raised up by force. This is a modification which, without having any thing objectionable about it, has nevertheless generally been neglected. Decourcelles (*Man. des Opér.*, etc., p. 385, 1756) obtained the same result by keeping the limb flexed while he incised the integuments in front.

3. *Process of Physick*.—M. Ch. Bell considers himself the inventor of a process which Dorsey (*Elem. of Surg.*, t. II., p. 317) ascribes to Physick, but which rather belongs to Decourcelles, (*Opérat.*, p. 385,) and which is as follows: first the skin is divided, then the muscles of the calf are cut very obliquely from below upwards, completing the circular section much nearer the knee on the anterior half of the leg, and terminating the operation as in the ordinary mode.

4. *Process of B. Bell*.—M. Baudens (*Thèse No. 51, Paris, 1829*) after having circularly divided the soft parts, proposes that we should detach all the muscles to the extent of an inch or two, with the point of the knife held in a direction parallel to the axis of the bones. This advice which was given by Bell, and which has been adopted by M. Champion in amputations of the arm or thigh, and for all amputations in general, may have its advantages, and is in concurrence with the precept lately revived with much earnestness by M. Hello, (*Thèse No. 258, Paris, 1829*.)

5. *Dressing*.—In operating at the place of election, we have in succession to seize the *anterior tibial artery*, associated with its nerve, and which must be separated from it in front of the inter-

osseous ligament, between the tibialis anticus muscle and the extensors of the toes; then the posterior tibial artery, the peroneal and some branches of the surales, (des jumeilles;) and sometimes also the nourishing artery of the tibia.

Very frequently the first of these vessels retracts far into the tissues, the reason of which, according to M. Ribes, (*Mém. de la Soc. Méd. d'Emul., Arch. Gén. de Méd.*, 2e sér., t. III., p. 199,) is found in the double curve which the artery is obliged to make, in order to get in front of the inter-osseous ligament. M. Gensoul (*Thèse No. 109*, Paris, 1824) on the contrary thinks that this [apparent] retraction is owing to the fact that the muscular fibres which surround the artery, being too adherent to mount upwards, make the vessel appear to retract much more than it in reality does, much more even than those of the posterior part of the limb which the muscles draw up still higher. The difficulty of finding this artery, according to M. Sédillot, (*Gaz. Méd. de Paris*, 1833, p. 363,) is owing to the knife mashing (mâcher) and bruising it in dividing the muscles of the inter-osseous space. Without absolutely rejecting the first and third of these explanations, I would more willingly adopt the second. When the section of the bones is made immediately below the tuberosity of the tibia, one trunk alone replaces the posterior tibial and the peroneal, but then we meet also with the nourishing artery which here possesses considerable volume. Higher up still the anterior tibial itself may not have yet separated from the popliteal, [*i. e.*, strictly speaking, from the *peroneo-tibial* trunk of the popliteal, which trunk and the anterior tibial form the two great divisions, *i. e.*, the bifurcation of the popliteal itself. T.] which last artery alone [*i. e.*, the popliteal] in that case requires a ligature, together with the inferior articular and the surales.

Practitioners differ also as to the *direction which should be given to the union of the wound*. In France it is almost always obliquely from within outwards and from before backwards, as is recommended by M. Richerand. Many operators in England, among others M. Hutchinson, still unite the wound as formerly, directly from before backwards, hoping by this means to avoid the stagnation of the fluids and the pressure of the point of the tibia against the skin. To give in fact greater security to this method, M. Larrey advises to slit the skin in front and behind, to the extent of half an inch. There are others again who unite transversely after the recommendation of M. Guthrie; but there can be no question that if we have adopted the precaution of removing the angle of the bone as has been pointed out, that the method of M. Richerand is the best; and that this alone enables us to bring the tissues in a line with the smallest diameter (*épaisseur*) of the limb, and that it presents in no way any obstacle to the discharge of the pus.

If the amputation has been made very low down, the leg should be supported upon a cushion, and kept slightly flexed and inclined upon its outer side; otherwise we place the stump upon small pillows (*oreillers*) which raise the ham much higher, and prevent the wound from pressing against the mattress.

II. *The Flap Method*.—It was to the leg particularly that Lowdham, Verduin, Sabourin, &c., were desirous of applying their method. It was upon this part of the limbs also that Garengoet, De la Faye and Le Dran made their first trials. But Louis, Lassus and Sabatier, having undertaken to establish the circular method, and the flap operation seeming to be more painful and difficult, it was almost entirely renounced. It is now, however, near thirty years since it was again revived among us by M. Roux and Dupuytren. Hey in England, and Klein and M. Benedict in Germany, who eulogize it much, succeeded in causing its adoption by some of their countrymen. Heliodorus (Peyrilhe, *Hist. de la Méd.*, in 4to, p. 392–393) also, who first divided the soft parts in front, then sawed the bones and finished with the section of the muscular masses behind, did he not follow the flap method, he who so accurately applied to supernumerary fingers the so called method of Ravaton? What appears, however, to have chiefly deterred the moderns from it is the size of the tibia, whose inner face, taken in whatever way we choose, can never be covered by any thing but the skin. The necessity, also, of taking the greater portion if not the whole of the flaps from behind, was another motive for its exclusion. As, however, there may be cases where it becomes indispensably necessary, I believe it my duty here to point out the principal processes by which this operation may be performed.

a. *Process of Verduin*.—A two-edged knife, plunged into the leg at a point a little below where we intend to apply the saw, first cuts out at the expense of the calf, a semi-lunar flap of about four inches in length; the instrument being then brought in front is immediately afterwards made to divide the integuments and muscles as in the circular method, at the base of the flap which has been raised up; the inter-osseous fossæ are then cleared out (*degagées*) and the bones sawed as in the usual way.

Loder and M. Graefe (*Rust's Handbuch der Chir.*, t. I., p. 569) have modified this process in this, that in order to leave a less quantity of muscle they draw the skin back forcibly while making the incisions, and also preserve a small flap in front.

b. *Process of Hey*.—In order to be more sure of the length of the flap, Hey advises to mark out the middle of the upper part (*hauteur*) of the tibia by a circular line, then to trace out a second an inch lower down, and then a third at four inches below the first; afterwards he makes two others, one on each side, parallel to the axis of the limb, and which are drawn from the union of the two anterior thirds with the posterior third of the superior circular line down to the lowermost circular line. The first indicates the point where the bones are to be sawed; the second that at which the integuments are to be divided in front, and the third the place where the knife must be arrested; while the two lateral lines give the form and extent of the flap; which in other respects Hey cuts out in the same way as Verduin and Lowdham. No one I should judge among us would be tempted to follow this scaffolding of geometric lines and rules.

c. Process of Ravaton.—The circular incision made at four inches from the place where the amputation is to be performed, allows of another being placed on the inner side and near the inner border of the tibia, then a third on the outer border of the leg, and both of which are to fall upon the first at a right angle. The two square or trapezoidal flaps, one anterior the other posterior, which result from these incisions, are then to be dissected from below upwards and raised up; nothing more remains to do than to clear out (*dégarnir*) the inter-osseous space, introduce the split compress and saw the bones.

d. Process of Vermale.—In order to form the first flap, Le Dran (*Opérat. de Chir.*, p. 55) who states that he has performed the method of Ravaton and Vermale successfully, carries the knife from the inner to the outer side of the leg, and thus begins by forming the anterior flap; nothing then is easier than to draw back a little the fleshy tissues behind and cut out a posterior flap.

e. Process of Dupuytren.—Instead of commencing with the anterior flap, Dupuytren first plunges his instrument between the posterior surface of the bones and the soft parts, taking care to leave more tissues behind the fibula than Le Dran did.

f. Process of M. Roux.—As it is next to impossible to preserve as much of the tissues in front as behind, M. Roux has proposed to make an incision on the inner face of the tibia about 2 inches in length, which commences upon the inner border and runs obliquely from behind forwards, and from above downwards, and terminates on the anterior border of the bone. This incision, when the posterior flap is formed, readily allows of our bringing the edges of the wound up to a level with the crest of the tibia, and of making a flap in front which possesses greater regularity and thickness.

III. *Ovalar Method.*—By slightly modifying the circular method for the leg, we may easily transform it into the ovalar. For this purpose it is sufficient to divide the skin in such manner that one of the extremities of the antero-posterior diameter of the incision, shall be manifestly placed nearer the thigh than the other. Thus M. Baudens (*Clin. des Plaies d'Armes-à-feu*, p. 50) who extols this method, places the apex (*sommet*) of his oval behind towards the ham; while M. Sédillot (*Gaz. Méd. de Paris*, 1833, p. 363) recommends that it should be in front towards the knee.

IV. *Appreciation.*—All the flap processes in fact are reducible to that of Lowdham and that of Vermale, the one allowing of but a single flap, the other furnishing two. When the skin is degenerated much higher up in front than behind, and that we are obliged to amputate very near the knee, the first is the process that becomes necessary. I have seen M. J. Cloquet employ it successfully at the Hospital of Perfectionnement, upon a patient, who but for that would have evidently lost the thigh. Under all other circumstances, the method with two flaps appears to me more suitable, though it be a little more difficult. When there is only one flap we are obliged to make a right angle with it near its base in order to apply it against the bones. Immediate and complete union is next to

impossible; and sufficiently acute pains rarely fail to come on. The accidents which may result from the method in question, justify to a certain extent the fears of surgeons of the present day, and their repugnance to undertake it. By means of two flaps on the contrary we can easily close the wound; the parts being neither angulated nor drawn upon, are found in the conditions the most favorable possible for immediate reunion.

In *making trial* on the dead body with the process of Vermale, and which I have once at the Hospital of Saint-Antoine employed on living man, I omit the small preliminary incision of M. Roux; but I take care to embrace with the left hand the two sides of the leg, and to draw as much of the integuments as I possibly can towards the front. The point of the knife is then directed upon the inner face of the tibia; brought up to a line with the crest of this bone, while pushing the skin before it; passed along in front of the inter-osseous ligament; a little raised up in order to pass in front of the fibula, and again inclined backwards, while the operator draws the tissues towards him, at the moment the knife is cutting through the outer border of the limb. The flap being thus cut out, we return to form a similar one behind, while the rest of the operation being based upon the process of Dupuytren, presents nothing peculiar.

In whatever manner we proceed, it is necessary that the inner angle of the wound should not be quite as high up as the other, if we do not wish to run the risk of denudation of the bone and necrosis. As a general rule, the circular method merits the preference over the flap process, but this last presents advantages which we may profit by, when either at the lower or upper third, the soft parts on the periphery of the leg have degenerated much higher on one side than the other. By enabling us to preserve what is sound, it puts it in our power also to avoid removing so large a portion of the bones. The same may be said of the ovalar method. As to immediate reunion, which some of these processes are said to effect with more certainty than others, it will be necessary in the first place to establish the fact that this has ever actually been accomplished, which has not been done up to the present time. On this subject I fear more importance has been attached to the process itself than to the facts in the case. In no case do I find that the wound definitively closes without any suppuration. M. Serre, (*Gaz. Méd.*, p. 825.) who in France zealously advocates primitive reunion, and who, to ensure it with more certainty, uses the suture after amputations, never, however, cures his patients under fifteen days. Now I have obtained results no less satisfactory, by the method I have pointed out for treating amputations in general.

[LIGATURE ON THE FEMORAL AND EXTERNAL ILIAC ARTERIES FOR HEMORRHAGE AFTER AMPUTATION OF THE LEG.]

One of the most complicated and embarrassing, not to say dangerous, cases of surgery on record, (See *Cormack's Lond. & Edinb. Monthly Jour. of Med. Science*, Feb. 1843, p. 109, &c.) in which the

operator successively triumphed over the most formidable and alarming obstacles, and finally succeeded in saving the life of his patient, was that of an ostler, aged 20, brought to Gray's Hospital, Elgin, (England,) July 30, 1842, and placed under the care of Dr. John Paul, surgeon of that institution, who exhibited in the treatment undaunted courage and clear judgment. Though not stated, the patient, from his age and profession, is presumed to have been in robust health, at the time of the accident, which was a comminuted compound fracture of both bones of the leg, and protrusion of the tibia, caused by his jumping from a gig to stop the speed of his horse. The fracture on the projecting portion of the tibia was removed, and the limb comfortably arranged in Liston's splint. On July 18th, an abscess, with an erysipelatous discoloration of the skin, and pain of the internal saphena formed on the side of the leg opposite to the wound, from which proceeded a copious fetid discharge. The ends of the bone having become displaced, Pott's splint was used. July 24th—the symptoms all abated, pulse became 80 and feeble. Porter was now substituted, and the calomel and opium omitted. July 27—the wound discharging largely of fetid matter, fracture loose and easily moveable. August 2d—discharge healthy, pulse tranquil, tongue clean. Aug. 9—*Profuse hemorrhage* having come on this evening from the wound, amputation by the double flap was performed above the knee, only four vessels requiring the ligature. The flaps were exposed for *some hours to the action of the air*, and then brought together by sutures and adhesive straps. On the evening of the 15th of August, though the union of the flaps was almost complete, and no unpleasant symptom had occurred, the stump being only slightly swollen, and the pulse somewhat frequent, *hemorrhage* from the stump *supervened* but to no great extent; but sufficient, in the opinion of the surgeon, to justify a *ligature upon the common femoral*, nearly an inch below Poupart's ligament. The bleeding ceased immediately, and the wound was brought together by three sutures. During the five succeeding days, there continued constantly a *strong pulsation* from Poupart's ligament down to the ligature, but none below the latter, with more or less *profuse discharge* of colored matter from the stump, on the second day of this interval, brought on in some measure, perhaps, by warm *poulticing* to the stump, to promote its discharge, which had been scanty. On Aug. 28, however, the ligatures from the stump had come away, and the wound in the groin was granulating. To the surprise of the surgeon, the *hemorrhage* was again renewed, in the afternoon of Aug. 30th, and this time from the *common femoral*. It was immediately arrested by pressure, which had not to be continued but for a short time. Only three ounces of blood were lost. The ligature was loose in the wound, and was removed. On the evening of the next day, the hemorrhage from the femoral was renewed to the extent of 8 or 10 ounces. A *ligature* upon the *external iliac* was now immediately determined upon, as the only reliance, and it was accordingly applied by means of an incision four inches in length, commencing

an inch above Poupart's ligament, and keeping the line of incision nearer the ilium than is generally recommended. The edges of the wound were brought together by three sutures.

Sept. 1.—Considerable febrile reaction, pulse 120 with thirst, and some retching, which were allayed by citrate of potash and morphia.

Sept. 2.—Fever continues, and the wound in the iliac region discharges some fetid matter; stump nearly healed. The fever having somewhat subsided, but the pulse still remaining at 110, and the tongue becoming *red*, though the bowels had been well operated upon, the patient was put on quinine in minute, half-grain doses, three times a day, with a glass of port wine, sago, and arrow-root.

Sept. 16.—The pulse natural, tongue improving; discharge from the wound healthy; the ligature remains; the bowels well regulated by castor-oil.

Sept. 30th.—Slight pulsation was observed to-day, in the common femoral in the groin, where the ligature was applied, being the first time since the application of the ligature, on the iliac. The wound in the groin, however, had entirely healed, with the *exception* of a very small point, and this point appeared to be a *coagulum of blood protruding from the artery*. Directed to be rubbed with the nitrate of silver and the wine to be omitted.

To October 7th, the *arterial* pulsations mentioned, grew stronger and stronger, though the patient was otherwise doing well, as also the wound in the iliac region. There was some slight diarrhoea, a red tongue, and quickness of pulse. The pulsation seemed so superficial, that the blood apparently was restrained only from gushing out by a *small coagulum* and the *crust* formed by the nitrate of silver. Chalk mixture and opiates given.

From thence for two days, to Oct. 11th, the patient appeared to improve and the pulsations to subside, but on this date they increased again. On the 13th October, upon the removal of a small coagulum, the blood instantly gushed out with violence. This was arrested by compress and bandage, but on Oct. 16, profuse hemorrhage again took place, which, after removing the dressings, was kept under by the hand till next day, when on the recurrence of another hemorrhage, the ligature was applied again a little higher up, by means of an incision, from the place of bleeding as far as about an inch above Poupart's ligament, this ligament being completely divided, and the vessel secured just as it was about to pass under the crural arch, being about two inches below where it had been previously tied in the iliac region, and one above where it had been tied in the groin. On Oct. 24, the wound began to discharge healthy matter, and to granulate. On the 26th of Oct. the ligature upon the femoral came away; but that upon the external iliac not until November 18th following, leaving, however, the loop on the vessel.

Dec. 1.—Both wounds healed, and the patient sitting up.

Remarks.—In cases of great complication and danger, like the foregoing, and recovery from which, as in the instance before us,

was almost miraculous, proving conclusively how much, decision, boldness, and perseverance, however thwarted or disconcerted, may do to save human life, Dr. Paul thinks, that the tying of the femoral below the profunda, would be sufficient, if the blood should come from the femoral itself; but if it comes from any branch of the profunda, the main artery must be secured above where the profunda comes off. In the instance above, not knowing the source of the hemorrhage, he tied the common femoral nearly an inch below Poupart's ligament, and this controlled at once the bleeding from the stump; but at the end of a fortnight, when the ligature separated, hemorrhage took place from this vessel. Pulsation continued very strong at the ligature, from the time of its application till it came away, *evidently showing*, says he, *that no clot was formed*; and the occurrence of hemorrhage, he adds, was no doubt owing to this not taking place. From this and other cases, he comes to the conclusion that a ligature on the common femoral is an unsafe operation; the cause probably being, as he thinks, the want of space there for the formation of a clot; for so many collateral branches are given off that the blood does not remain quiescent above the ligature.

The return of pulsation to the common femoral, and the blood getting into this vessel on the thirty-first day after the external iliac was tied, and the renewal of the hemorrhage from the common femoral on the forty-fourth day after the application of the ligature to the external iliac, must, he thinks, have been owing in a great measure, if not entirely, to the retrograde motion of that fluid in the epigastric; for the circumflex ilii was divided and tied, in securing the external iliac. It appears, then, that placing a ligature on the external iliac, only cuts off the supply of blood from the common femoral for a certain time; for, on the thirty-first day after tying the former vessel, pulsation was observable in the latter; and if the external iliac had been tied for aneurism in the groin, the operation would not have been successful without, he thinks, again securing the vessel where he did. In the last operation, continues Dr. Paul, if I had not been certain that the circumflexa ilii had been previously secured, I would, on exposing the artery under Poupart's ligament, have dissected its trunk up towards the point where it had been tied in the iliac region, and by this means I would have been enabled to tie both circumflexa ilii and epigastric arteries; but the circumflexa ilii being impervious, securing the femoral artery where I did, under the crural arch, had the same effect as placing a ligature upon the epigastric itself, the source whence the blood came. In the treatment, then, of secondary hemorrhage after amputation of the thigh, if the bleeding vessel or vessels cannot be secured on the stump, I would, in the first place, tie the superficial femoral, at a sufficient distance below the origin of the profunda, on the ground that the blood came from the main trunk. This failing, I would at once secure the external iliac rather than the common femoral; for the result of tying the latter vessel appears to be so unfavorable, that I believe *it ought*

never to be thought of, either to arrest secondary hemorrhage after amputation, or to cure aneurism, as hemorrhage from this vessel, on the separation of the ligature, so frequently happens.

This case, to the same extent that it powerfully strengthens the objections against a ligature upon the common femoral for any disease, becomes also a cogent reason, if not an argument, in favor of availing ourselves of the ingenious and successful mode of employing compression to this trunk, as adopted by the surgeons of Dublin for aneurism; (see our note on this subject, under Aneurisms, above;) for if what Dr. Paul says be true, the femoral must henceforward be thrown out of the category of arteries to which ligatures can be applied. Not that we pretend that compression could, in a case like the above, be substituted for the necessity of a ligature somewhere upon its trunk above the stump; all we wish to say is, that such cases show that, in dealing with the femoral as for popliteal aneurisms, we must come to something besides the ligature; and this there is every hope for believing Drs. Hutton, Bellingham, and others of Dublin, have nearly or quite accomplished in their perfected compressors to the femoral trunk. (See a similar case of Dr. Mott's, under his Remarks on Aneurisms, &c., supra.) T.]

§ II.—*Amputation at the Knee.*

A. The disarticulation of the leg, though obscurely alluded to by Hippocrates (*De Articul.*, t. II., p. 381, edit. Vanderlinden) and Guy de Chauliac, (*Trad. de Joubert*, p. 464,) and more clearly specified by Fabricius de Hilden, (*Observat. Chirurg.*, p. 504,) did not, however, seriously attract attention until the last century. Notwithstanding the efforts of J. L. Petit, (*Malad. Chirurg.*, t. III., p. 20,) Hoin and Brasdor, who endeavored to bring it again into repute, it was recommended by no one, and M. Blandin was almost the only person who had the courage to reproduce the arguments of Brasdor in favor of it; it was, in fact, an operation which at the first glance seemed destined to be proscribed from modern surgery, until I myself, in 1829, made the attempt to re-introduce it into practice.

De la Rocque (Planque, *Biblioth.*, t. V., p. 12, in 4to.) informs us of the case of a young girl seventeen years of age, who was amputated at the knee, and recovered perfectly. In one of the cases mentioned by J. L. Petit, the amputation of the knee appears to have been had recourse to only because the instruments to perform it in the continuity were wanting. The other was a young man who had both bones of the leg in a state of exostosis and caries throughout their whole extent. There is every reason to believe that these two operations, of which J. L. Petit was a witness only, resulted in a perfect cure. A slater, who nineteen days before had fallen from a height of thirty-two feet, was received into the hospital of Dijon on the 26th of July, 1764. His leg was in a state of gangrene as high up as the knee. Hoin (*Mém. de l'Acad. Royale de Chir.*, t. V., p. 508, 1819) disarticulated the leg, and though there

were not soft parts sufficient to allow of immediate reunion, the man ultimately got well. In the month of July, 1771, he was still living, could use his wooden leg with freedom, and ascended the scaffoldings and upon roofs as he had done before the accident. Gignoux, (*Ibid.*, p. 512,) of Valence, speaks of a young girl whose leg had been separated from the thigh by gangrene, and whose health for the last four years had been completely restored. Sabatier (*Méd. Opér.*, t. IV., p. 548., 1824) mentions having seen a boy in whom a ball had carried away the leg without wounding the patella, but without being followed by any unpleasant consequences. Dr. Smith, (*Journal des Progrès*, t. I., p. 240,) in the year 1824, disarticulated the leg in a young lady, who, ever since, has been enabled to walk by means of a wooden substitute. A scrofulous patient was amputated in the same manner, in the year 1824, at the hospital of Saint Louis, by M. Richerand. A variety of accidents, such as purulent abscesses and collections, it is true, at first alarmed the surgeon, but the wound, nevertheless, ultimately cicatrized. M. Dezeimeris, in 1829, met, in the streets of Paris, with a male adult who had been amputated at the knee. This person could walk with ease, but by means of a cuish (cuissart) and without using his stump as a point d'appui on the artificial leg. M. Bourgeois has told me that he has noticed a case in every respect similar, at Etampes. Rossi considers this operation as very simple, and says he has performed it twice with success; but the patient who was operated upon by M. Blandin, at the hospital Beaujon, died on the tenth day after the operation, in consequence of phlebitis.

B. Appreciation.—Thus have we 14 authentic cases of amputation at the knee joint, and of these, 13 cures; which, it cannot be denied, is for the first, a most encouraging result. Amputation in the continuity has certainly never furnished more satisfactory proportions. To those who would object that the amputation in the patients of Gignoux and Sabatier was performed as much by nature as by the surgeon; that gangrene had done part of the work in the cases mentioned by Hoin; that that of M. Blandin ultimately died; that all were young subjects, and could not use their stump for a long time; we may reply:—1, that if the wound properly closed after the spontaneous fall of the limb, or after gangrene had already commenced the division of the tissues, there is no reason why it should be otherwise when the operation has been performed by art; 2, that the accidents to which one of the patients came near falling a victim, do not belong to disarticulation more than to pure and simple amputation of the leg, and that his death, which occurred eight months after, was the result of his primary affection; 3, that we cannot see why adults should have less chances of success from this amputation than young persons; 4, that the length of the cure must be imputed to peculiar circumstances, and not to the character of the operation; 5, finally, that M. Smith had no complaint to make in respect to any of these inconveniences. But let us continue the exposition of facts.

In the month of January, 1830, I received into the Hospital of Saint-Antoine, an orphan boy, aged 19, who was addressed to me by M. Kapeler. The operation was fixed for the 14th of the same month. As there was not a sufficient quantity of soft parts remaining behind, I proposed to obtain a flap in front, of a certain length. The wound reunited but imperfectly. No accident happened, and though there still remained exposed a transverse surface an inch in width from before backwards, which the flaps would not cover, the cicatrix, nevertheless, was completed at the expiration of two months. This patient, whom I have often since seen, enjoys the most perfect health. The stump bears and transmits the weight of the body to his wooden limb with the same facility as if he had undergone only amputation in the continuity of the leg.

A man, 29 years of age, of good constitution, and born in the colonies, was sent to me at the Hospital of Saint-Antoine on the 24th of May following, by M. Thierry, who had been sent for to him for a comminuted fracture of the left leg. Gangrene soon made its appearance, followed shortly after by an ichorous suppuration, which becoming more and more copious, with pains excessively acute at the time of dressings, and even in their interval, and an almost continued febrile movement, with diarrhœa, &c., soon made me, on the other hand, entirely despair of saving the limb. I decided upon amputation at the knee, and performed it on the 4th of June. The febrile reaction made it necessary to bleed on the first and second day. No accidents afterwards occurred up to the fifth; but on the sixth and seventh, a superficial erysipelas made its appearance, and reproduced the fever. In spite of this intercurrent phlegmasia, and of two small purulent patches, which formed at a later period at the angles of the condyles, and finally, of the consequences produced by deviations in regimen, causing, in fact, a real attack of indigestion, the cure was completed by the sixtieth day.

In the month of July, 1830, I had to examine, at the Bureau of Hospitals, a young man aged nineteen years, who had been amputated seven years before, and who came to ask for a new wooden leg. He told me that the operation had been performed upon him at the Hôpital des Enfants. The cicatrix was behind, and though the inner condyle, from being an inch longer than the other, could alone rest upon the artificial limb, he has, nevertheless, always been enabled to walk as well as if he had undergone amputation below the joint.

Since that period, the disarticulation of the leg has been performed once with success, by M. Nivert of Azai-le-Rideau, on an adult man, who had his limb shattered by the discharge of a musket, (coup de feu.) M. Baudens, (*Bulletin de l'Académie Royale de Médecine*, t. I.,) has published an additional case; M. Chaumet has informed me of another successful one by M. Pichozel; and an American surgeon has related to me that he has performed it twice with a fortunate result. Some other practition-

ers have not had the same good fortune. A patient operated upon by M. Jobert, (*Plaies d'Armes-à-feu*, p. 293,) died in consequence of suppuration in the thigh. M. Laugier, who performed it twice, lost both his patients, and I have seen myself four fatal terminations. It is true that in all of them the amputation was performed under the most unfavorable circumstances. I am informed by M. Blandin, that the state of his patient scarcely allowed of the slightest hope, even before the operation. It was the same with two patients on whom I performed this operation at La Pitié, in 1831. The one an old man, with gangrena senilis, died on the twenty-eighth day in consequence of the mortification having reappeared in the stump. The other, an extremely fat woman, with an enormous encephaloid (cerebroïde) cancer of the leg, which prevented me from preserving the integuments, except on the inner side, was attacked with an extensive suppuration throughout the body of the thigh, and with a large ulceration upon the sacrum; she died on the sixty-second day, without there ever having appeared, however, anything of a bad character in the wound itself. One of M. Laugier's patients had at the same time a comminuted fracture of the thigh; and one of those upon whom I have performed the operation at La Charité, a woman seventy-six years of age, died, exhausted in consequence of the long continuance of her sufferings. I should add, however, that my fourth patient, who was a man of 47 years of age, was strong and in favorable conditions. I fear, therefore, that I may have exaggerated the safety of this operation when I attempted to revive it in 1830, (*Archiv. Gén. de Méd.*, t. XXIV., p. 44.) It remains proved, however, that the objections which have been made against it have no solid foundation: 1, By exposing, it is said, large and cartilaginous surfaces, we incur the risk of formidable accidents. But this cartilaginous plate which invests the condyles, is a protecting covering, (lame,) entirely destitute of sensibility, and which will remain for weeks entirely denuded, without the slightest inconvenience resulting from it. As the pretended synovial membrane, which Bichat has provided it with, does not exist, it is utterly impossible for this surface to become inflamed; 2, It produces an enormous wound, which it is next to impossible to cover by the surrounding soft parts. This is a mistake. This wound, so vast in appearance, is reduced, on a close examination, to a division of the integuments, and some fibrous layers and muscles. Provided the skin can be preserved to the extent of two or three inches, it is always quite sufficient to procure immediate reunion. 3, This wound is made on tissues which are not capable of becoming inflamed to the degree required, or which do not allow of a prompt and solid cicatrix, as in the fleshy part of the limbs. Persons are deceived on this point as well as on the other. Nothing is better than the cutaneous tegument; this alone is perfectly adequate (*propre*) to the formation of a good cicatrix. Let the whole synovial surface of the condyles be covered with it, and it will agglutinate as well as upon the cut surface of a bone or large-sized muscles. 4. This operation being more painful and

more difficult, is not followed by as rapid a cure as an ordinary amputation. This objection is not more solid than the preceding ones; as the facts above indicated sufficiently establish. 5. Another objection, and one which has been most insisted upon, is, that it leaves the patients after the cure in the same state as those who have had the thigh amputated, that is to say, that they are compelled to walk with a crush instead of a wooden leg. I confess that this, for a long time, was an objection in my mind. But this is one, in fact, which it is not necessary to discuss at present, as the cases I have related are before us to determine its just value.

What then should be the reasons that ought to induce us to proscribe it? After amputation of the thigh, however low down we may perform it, the point d'appui, for the artificial substitute, can only be made upon the ischium. The motions of the haunch are almost completely abolished, and progression is made in the same way as if the coxo-femoral articulation was ankylosed. After disarticulation of the leg, however, the point d'appui is found at the extremity of the femur. The thigh preserves all its movements, and the patient is in the same condition as if he had a simple ankylosis (soudure) of the knee. If it be true that, in respect to the functions of the limb, it is infinitely better to perform amputation of the leg in the continuity than to perform it upon the thigh, the advantages of disarticulation at the knee should equally be deemed to be placed beyond all dispute, because the weight of the body is transmitted to the artificial limb in the same way after this last operation as after the first. The wound in the one belongs almost entirely to the skin, and involves no bone and no aponeurosis; the surface to cover is convex, regular, destitute of every kind of roughness, and has nothing to fear from muscular retraction. In the other, on the contrary, the solution of continuity comprehends a vast enveloping aponeurosis and all its concentric laminæ, muscles without number and of considerable volume, a bone which is denuded with the greatest facility and whose section produces a concussion (ébranlement) which is far from being always without danger, and, finally, the entire cellular tissue which unites all these various parts. In the knee, one artery alone of any considerable size is divided; torsion or compression controls this almost with as much certainty and ease as the ligature. At the thigh, besides the principal artery, we have a multitude of secondary branches, which all require to be tied with care.

If the amputation of the leg in the contiguity is dangerous, it is because of the large and deep synovial cul-de-sac which is prolonged upon the sides of the condyles, and upon the anterior surface of the femur. Purulent inflammation, if once established in this cavity, becomes almost as formidable as in a great articulation. Soon reacting upon the body of the thigh, it creates there a swelling, an erysipelatous blush, and a cakiness, (empâtement,) which are not long in extending outwardly to the hip—ending in suppuration and abscesses, which pervade the whole extent of the muscular tissues. It was from these causes that three of my patients

perished, as well as those of MM. Blandin, Jobert, and Laugier. The boy operated upon by M. Richerand experienced similar accidents; and when they make their appearance, there is real cause for serious apprehensions. If this cause of dangers could be abstracted, my first opinion on amputation at the knee would remain correct. The disarticulation of the leg, therefore, without being a serious operation for the reasons put forth by the surgeons of the present time as by those of the last century, is, however, on the other hand, sufficiently so not to be undertaken when it is possible to amputate lower down.

C. *Operative Process*.—The patella, which J. L. Petit recommends should be removed, should always be preserved; the muscles raise it up, and soon fix it above the condyles, where it can neither interfere with the cicatrization, nor with the uses of the stump after the cure is completed.

I. *Process of Hoin*.—The process of Hoin, carefully described by Brasdor and the only one mentioned by French authors, and which consists in penetrating the joint below the patella from before backwards, in order to terminate by cutting a large flap at the expense of the calf, has more than one inconvenience. The anterior lip of the wound, drawn upon by the action of the muscles and the natural retractility of the tissues, often afterwards ascends above the cartilaginous surfaces. Its angles, now flaring open and pushed back by the lateral projection of the condyles, soon leave a portion of the bone denuded, in spite of all we can do. The flap, always thinner at its root than at its point, is badly adapted to the parts which it is intended to cover. The state of the tissues, also, sometimes renders it difficult to give it sufficient length to bring it with ease to the border of the retracted patella. Finally, it is rare in fact that the cicatrix is sufficiently high up to leave no room to apprehend some degree of pressure upon it in walking or standing.

II. *Process of Lèveillé*.—If we confine ourselves, after the manner of Lèveillé, (*Nouv. Doctrine Chir.*) to cutting a flap at the expense of the soft parts anteriorly, we can rarely give extent enough to it for the cicatrix to become sufficiently remote from the point d'appui of the condyles. Moreover, this mode of operating has not been noticed in any work, except perhaps that of Monteggia, who barely alludes to it.

III. *Process of M. Blandin*.—Nor can I perceive what we should gain by commencing, instead of finishing, with the posterior flap; nor what good would result from making a precautionary (d'attente) counter-opening in the hollow of the ham for the passage of the ligatures and pus, as is proposed by M. Blandin.

IV. *Process of M. Smith*.—By cutting two flaps, as suggested by M. Smith, or rather by Béclard, as I am informed by M. Belmas, who assisted at the operation upon the child mentioned farther back, we are not under the necessity of borrowing so much tissue from the calf. Compelled to adopt this process with my first patient, I acquired the conviction that it presents at least as many advantages as those of Petit, Hoin, and Brasdor. Whether, how-

ever, there be one flap or two, nothing can prevent their shrinking and retracting as they thicken, and consequently their leaving a greater or less considerable portion of the condyles entirely denuded; from whence it results that the cicatrix in this part can never be completed, except by a tissue of new formation.

V. *Process of Rossi*.—The method of Rossi, (*Méd. Opér.*, t. II., p. 227,) which consists in cutting one flap upon the inside and the other upon the outside, instead of in front and behind, though still more objectionable, is not, however, to be wholly rejected when the skin is much less altered upon the sides than any where else.

VI. *Ovalar Process*.—M. Baudens, (*Bull. de l'Acad. Roy. de Méd.*, t. I., p. 325,) by dividing the skin in front an inch lower down than behind, obtains a wound of an oval form, whose apex terminates in the ham. M. Sédillot, who arranges his oval in an inverse manner, is obliged to prolong its point towards the patella. In one case I was myself obliged to place the oval transversely; but these processes, though useful where the integuments are degenerated higher up in one direction than in another, are, as a general method, less suitable than the following.

VII. *New Process*.—a. In the process which I have adopted, the skin is divided *circularly*, at three or four fingers' breadth below the patella, and without involving the muscles. In dissecting it, to raise it up, or to reverse it outwardly, we must take care to preserve the cellulo-adipose layer, which lines its inner surface, and also not to strip it of its sanguineous capillaries. An assistant is immediately to seize hold of it, and draw it back to the knee, until the ligamentous patella having been divided, the instrument can strike upon the inter-articular line; the surgeon then divides the lateral ligaments, widens the osseous surfaces by making slight flexions with the leg, detaches the semilunar cartilages, completes the section of the crucial (croisés) ligaments, traverses the joint, and terminates by dividing, with a single stroke of the knife, the vessels, nerves, and muscles of the ham perpendicularly to their track, and on a level with the raised-up integuments.

b. *Dressing*.—After having tied or twisted the popliteal artery, and the less important branches which may require it, the operator draws towards him all the skin that has been dissected, cleans it, and if his intention is to effect immediate re-union, approximates the lips in such manner that the angles of the wound may be placed transversely. Upon the supposition that primitive union cannot be attempted, a perforated linen should be applied upon the whole of the wound, which should then be filled with small balls of lint, (*charpie en boulettes*, see Vol. I.,) and these are to be covered with soft plumasseaux, (of lint,) and the whole supported by an ordinary containing bandage.

c. By this method the integuments represent a species of *purse*, or *ruff*, which envelop and cover the condyles as well upon the sides as in front and behind. As its mouth has a diameter somewhat less than its bottom, it is in the condition of a tight sleeve which one should attempt to slide up from the wrist towards the

elbow, that is to say, that it has very little tendency to slip up towards the thigh. The muscles being divided square off at their root, where they are very thin, can give place only to a very small bleeding surface, while they leave the skin free, and can no further aggravate the traumatic inflammation, or give apprehension of too abundant a suppuration, as in the other processes. Finally, the ligatures, if these are used, are applied with facility, assembled together at a point nearly approximated to the vessels they embrace, and in such manner as to irritate but to a very trifling extent the interior of the wound.

VIII. I do not wish to be understood, however, from these remarks, that all the other processes are henceforward to be discarded as useless. If the skin should be found to be too much altered in front and without, being so much so behind, we must rely on the method of Petit. The process of M. Smith, would to some extent, become a matter of necessity, if the degeneration proceeding higher up on the sides towards the condyles than on the anterior and posterior surfaces, had already traced out the limits of the flap to be formed. But in other cases, so often as circumstances admit of a choice, the circular method offers indisputable advantages, and deserves to have a general preference.

[AMPUTATION AT THE KNEE-JOINT.]

M. L. Blaqui re (*Jour. des Connaiss.*, &c., Paris, Ao t, 1844, p. 60, &c.) states, that while in Mexico, in 1833, he amputated at the Hospital of Saint Juan de Rio de Oaxaca, the right leg at the femoro-tibial articulation, in an Indian, aged about 25, of the village of Tlacolula, in whom the whole leg, to within a few inches of the knee, had become sphacelated from hot bricks, used during the cold stage of, Asiatic cholera, then prevailing in that capital. M. Blaqui re did not wait for the limitation of the gangrene, as the patient was in good condition, and without fever. He adopted the process of our author, M. Velpeau, and had every reason to be satisfied with it; for although the ruff of integuments intended as a flap to the condyles, also sloughed away, and the cartilaginous incrustation of the articulating surface of the condyles exfoliated, the surgeon, in another visit to Mexico, in 1843, found, on a visit from the patient, that the wound had perfectly healed, with a very small cicatrix, and that the limb had been made very serviceable by an apparatus which the patient had contrived. M. Blaqui re is strongly in favor of disarticulations, wherever they can be performed, in preference to amputations in the continuity. He considers the accidents in the latter, from the masses of muscular and aponeurotic tissues and large trunks that have to be divided, and which give in the thigh particularly so enormous a wound to the stump, as infinitely more dangerous. Mr. Syme, of Edinburgh, (vid. supra, Vol. I., his views on amputation at the elbow-joint, and in this volume this zealous advocacy of amputation at the tibio-tarsal articulation, and immediately above the knee, or near the great

trochanter, in preference to the continuity of the femur) entertains very similar views, and in this case probably would have sawed through the femur immediately above the exfoliating condyles. It is questionable, however, if, under the circumstances, the patient could have borne this additional shock upon the system. M. Blaqui re is of opinion that in all disarticulations, we should retain the least quantity possible of muscular tissues between the skin and the joint.

Mr. Syme *strongly urges amputation at the knee-joint*, in other words, disarticulation of the leg at its tibio-crural extremity, or amputation immediately on the *condyles of the femur*, close above the line of the articulating surfaces, in every case where it can possibly be done in lieu of the prevailing modes of sawing through the shaft of the thigh bone, at its middle portions. The next best place of division above, when it cannot be done at the knee or condyles, he considers to be the *trochanters*. All this practice he claims to himself the merit, in some measure, of having first endeavored to generalize and render popular, (Cormack's *Lond. & Edinb. Monthly Journal of Medical Science*, May, 1845, p. 338, et seq.) as he had previously enforced (*Ib.*) a similar practice in regard to the preference to be given to *disarticulation of the ankle-joint*, if it is possible to avoid section of the bones of the leg. Mr. Syme says the stern evidence of hospital statistics still shows the average of deaths not less than 50 to 70 per cent. in *amputations of the thigh, i. e.*, in the continuity, together with the frequent annoyance in many of the survivors, of a *protrusion of bone, accompanied sometimes with those tubular or conical exfoliations*, as they may be called, which he has seen extending into the interior of the femur for several inches, and which have to be extracted from the stump. Diseases of the knee-joint, as caries, and compound fractures of the leg and thigh, and tumors growing from the bones of the leg and thigh, are the cases which most frequently demand, especially the former, the process recommended by Mr. Syme. Diseases of the knee-joint, however great the scrofulous degeneration and suppuration, may be effectually cured, the Professor of Edinburgh says, by sawing through the condyles a few lines above the articulating surfaces, as is proved by his successes in these operations, and in his excisions of the elbow-joint, (See *supra*, in Vol. I. of this Amer. edit. of Velpeau,) and amputations at the ankle. For the same reasons, in compound fractures of the leg, where the muscles or integuments of the thigh would admit of amputation at its middle or lower third, we ought to give the preference to the section at the condyles. So also, similar injuries of the thigh obviously require amputation at the trochanters. These modes, he believes, would be eminently successful, and we are encouraged so to think, he says, from the fact that out of *twelve cases* of amputation at the ankle-joint, in his own practice, and as *many more* in that of other practitioners, who have been induced to adopt it, this operation (at the ankle-joint) *has not, in a single instance*, been followed by either the death of the patient, or exfoliation of the bone—even in cases where he would have declined amputating the leg as altogether desperate.

In the section upon the condyles, Mr. Syme prefers making pressure with the tourniquet where the artery enters the popliteal space—the tourniquet being a mode to which he would always give the preference in all amputations of the limb, rather than pressure at the groin with the fingers, which this surgeon has reason to believe from some post mortem examinations, has contributed to the production of phlebitis, if not to a fatal issue. In order to procure a better short flap in front, he makes his incision there semilunar and on a line with the lower edge of the patella, above which, as the integuments are drawn back, he carries his knife, and then pushing it from one side to the other under the joint, forms a long posterior flap out of the whole of the fleshy portion of the gastrocnemii muscles, by a bevelled or shelving edge—terminating the operation by sawing through the condyles, so as to remove the whole articulating surface, as this entire surface was sometimes found ulcerated and carious.

The value of this practice is, as remarked, strikingly exhibited he says in amputation at the ankle for diseases for which the leg has hitherto been removed,—viz., in caries of the astragalus and os calcis and of the ankle joint itself, destruction of the whole foot except the heel through exposure to cold, and compound dislocation of the astragalus by the effects of external violence, threatening to prove fatal by continued suppuration.

Mr. Syme has also recently (Cormack, *Loc. cit.*, p. 341) successfully performed amputation at the ankle joint, removing all the foot except the malleoli in an *infant* of only five months old, for a congenital erectile tumor upon the anterior part of the foot, which rapidly enlarged so as to involve the whole of that organ in an unshapely hypertrophied purple mass.

Caries of the bones of the foot is the condition of the parts which most frequently and imperiously demands this operation, instead of the reprehensible practice, as he considers it, still in vogue, of amputating in the continuity of the leg for such affections. T.]

ARTICLE VIII.—AMPUTATION OF THE THIGH.

§ I.—*In the Continuity.*

A. In the thigh, quite differently from what we do in the leg, we always amputate as low down as possible. The more length the stump has the easier it is to apply artificial limbs, (*les moyens prothétiques.*) The operation in itself one of the most dangerous, is so much the more so the nearer we go to the trunk. M. Langenbeck has recommended never to perform it at less than six fingers' breadth above the knee, alleging that lower down the artery is found imprisoned, as it were, in the sheath furnished to it by the adductor muscles, and from which it would be difficult to draw it out in order to apply the ligature. But whether the femoral artery be cut above or below the fibrous canal it traverses, or in the canal itself, there cannot in any case be any very great difficulty in seizing it, and no use certainly in dividing its sheath afterwards. As it is rare, on the other hand, that the disease allows of our making the

incision of the integuments at less than two or three inches above the patella, the result is that the section of the femur is almost always made at more than five inches above the articulation, and that the precept of M. Langenbeck therefore is superfluous. [By the note above it will be perceived, that so far from approximation to the trunk being deemed by some practitioners the measure of danger for the femur, Mr. Syme of Edinburgh will scarcely any longer hear of an amputation on this bone except at one extreme or the other, to wit, at the trochanters or the condyles, and never in the shaft. T.]

B. *Anatomy*.—As in the arm, we find in the thigh two layers of muscles; one superficial, composed of the rectus femoris, the sartorius, the gracilis, (grêle interne,) the semi-tendinosus, and semi-membranosus, and the long portion of the biceps flexor curis; the other layer deep seated and comprising the three portions of the triceps and the adductors. The first reaching from the pelvis to the leg, and each having in some sort a distinct cellular sheath which enables them to glide over each other (côté à côté) easily, necessarily possess a very great degree of retractility, and to a greater extent the lower down we make their division; the intimate union of the others on the contrary to the bone prevents their having more than a very limited power of retraction; from whence it is that it is the superficial layer of muscles only, which after amputation sometimes leave by their retraction the femur uncovered, and thus give rise to its protrusion. Near the pelvis we have, moreover, the psoas muscles and the iliacus internus, the glutæus maximus, the pectineus; then very high up the glutæus medius and glutæus minimus, the obturators, the gemelli, the pyramidalis, and the quadratus femoris, which by the distance from their point of origin, would tend much more to enlarge the wound than to denude the bone, if the amputation should be performed between the little trochanter and the hip [joint.]

The femur being a little curved forwards (bombé) at its middle part, is covered in front by a thinner tissue of soft parts and by muscles much less retractile than it is behind. From whence it happens, that in amputations of the thigh the cicatrix almost constantly inclines a little more or a little less backwards and inwards, and that the extremity of the bone scarcely ever corresponds with the centre of the stump. The crest which the bone presents on its posterior part, constituting the termination of a cylinder of sufficient regularity, easily splinters under the action of the saw, and is a point, therefore, that we should be on our guard against during the operation.

The femoral artery is the only important trunk we meet inferiorly. Being hidden behind the sartorius it is always easy to find. The great anastomotic, however, is not to be forgotten. As it is sometimes enveloped in the fibres of the third adductor, whose direction it takes, it is in certain cases very difficult to isolate. The profunda (musculaire profonde) and the perforating arteries, and nearer still to the pelvis, the superficial muscular artery and the

circumflex arteries, must be added to the femoral, (crurale;) the first on the front of the adductor muscles or in their substance, (épaisseur;) the second under the rectus femoris; the two others on the inside and outside a little above the small trochanter.

The femoral vein is so closely connected with the artery that the pressure upon the latter prevents the blood ascending in the former, and thus frequently becomes the cause of hemorrhage. The great sciatic nerve, free at the posterior part of the thigh in front of the superficial muscles, and destitute in itself of the least retractility, is found sometimes pendulous at the bottom of the wound, beyond the level of which it may project for more than an inch, making the dressings exceedingly painful. The best thing then to be done would be, as advised by Descot, (*Affect. Locales des Nerfs*, 1825,) to divide it immediately. Another nervous branch which also requires some attention is that which accompanies the crural artery. Its small size prevents it from being readily distinguished. Taking care, however, to recollect that it is always on the inner and anterior side of the artery or vein, there will not be much difficulty in finding it and pushing it aside. Inasmuch as it is quite possible that much of the pain of which persons amputated complain, in assigning it to the limb they have lost, may be caused by the ligature embracing certain nerves, it is necessary to avoid these cords with care while tying the arteries.

B. Operative Process.—**I. Circular Method.**—All that has been said of circular amputation in general, specially applies to the thigh. Of all the amputations in the continuity, this being the one that is the most serious and dangerous, is that which has particularly interested the attention of Fabricius of Hilden, Wiseman, Pigray, J. L. Petit, Le Dran, Louis, Pouteau, Valentin, Alanson, Hey, Desault, &c., in their treatises on removal of the limbs.

a. First Stage.—The patient being placed at the foot, or on the edge of the bed, or on a table, and his thigh left free up to its root, is supported by four or five assistants, one for the head and arms, another for the pelvis, a third for the sound limb, a fourth for the limb on the diseased side, and a fifth to raise up the tissues.

The tourniquet, or the garrot which some still use at the present day, and all kinds of bandages that were formerly in use above the point where the tissues are to be divided, in order to prevent hemorrhage, would prevent or, at least, interfere too much with the retraction of the muscles, and should be dispensed with. The practice of Louis and Bordenave, (*Mém. de l'Acad. Roy. de Chir.*, t. V., p. 59–60, in 4to,) adopted by almost all the moderns, and which consists in making pressure upon the artery on the body of the pubis, as it relieves us from this inconvenience, deserves the preference which is generally accorded to it. Noel, (*Réponse aux Quest. proposées par la Com. de Santé*, p. 24,) whom the commission of health asked which it was, the garrot or the tourniquet, that was employed in the army, replied:—"There is no longer any more talk in our army of the tourniquet and garrot, than of a Jubilee to the Jacobins of Paris." A pelote, pressed by an assistant against the

femoral artery at its egress from the lower belly, for amputations of the lower extremities, or applied with force under the arm-pit for those of the upper extremities, is advantageously substituted for those two pernicious instruments which have been the subject of as fierce disputes, he says, as the treaty of grace. The surgeon, unless under peculiar circumstances, would not be excusable in following the ancient method except there should be a deficiency of intelligent assistants. The inguinal bandage, devised by Pipelet (see *Atlas de l'Encyclop. Méth.*), at the suggestion of Louis, is also useless. Siegen, observing that the tourniquet was displaced in a patient that Boon (Richter, *Biblioth. Chir.*, t. X., p. 462) amputated, placed his fingers in the groin, and arrested the hemorrhage, so that Boon, who otherwise preferred the tourniquet to benumb the limb, already advises, at this epoch, to make pressure in the groin with the fingers upon a bandage rolled in the form of a pelote. In every case the tourniquet was to be placed as high as possible. In order that the root of the limb may always be embraced with the left hand, it is the practice in England for the surgeon to place himself always upon the right side of his patient, so that in amputation of the left thigh, the sound limb is interposed between the operator and the limb to be removed. There is no occasion for my criticising a rule like this, as every person among us will give it the name it merits. In France, the surgeon places himself on the outside for both limbs, which puts him under the necessity, for the left limb only, of consigning to the assistant the entire duty of raising up the integuments and muscular tissues.

b. Second Stage.—The first stroke of the knife, which ought to comprise, as far as possible, the whole thickness of the integuments, is made, in the first place, above the knee at four or five fingers' breadth from the point where the section of the bone is to be performed. Whether we reach or not the aponeurosis and subjacent muscular fibres, is a matter of no consequence; the important point is, that the skin shall have been completely divided. In order to favor its retraction, while the left hand of the operator or that of an assistant draws it back, it is important to recollect, that in front of the borders of the ham, it adheres more closely to the aponeurosis than anywhere else, and that, in this place, it is usually attached to the bottom of the supra-condyloid grooves.

c. Third Stage.—The knife being reapplied on a line with the retracted integuments, divides the muscles, if not down to the bone, at least through the superficial layer. After having drawn back this first layer, the surgeon applies the instrument upon the base of the cone which is formed by it; divides, with a third stroke of the knife, the remaining fleshy fibres; lays bare the femur; applies the split compress, crosses its two tails in front; divides the few tissues which may be still adherent to the osseous portion which he is about to remove, and saws immediately through the bone at five full fingers' breadth above the first incision. M. Van Onsenort, who places himself on the outside of the patient, divides, with the first incision, the skin and all the soft parts on the inner

and posterior side of the thigh down to the bone. While the divided muscles are contracting, he completes the section on the outer and anterior side, and terminates the operation by taking care to cut on a line with the extremities of the contracted muscles. I have followed this process without having any reason either to complain of or to applaud it.

Above the middle part of the thigh, the muscles retract much less; but as the volume of the limb is more considerable, we must here also commence at four inches below where the section of the bone is to be made. Nearer still to the hip, perhaps there would be some advantage in making use of M. Graefe's buckler (*en rondache*) knife, in order to form a funnel out of the soft parts, or we might divide them as Alanson or Dupuytren does by inclining the blade of the instrument upwards. In fact, their section perpendicularly makes almost a square-shaped wound, whose borders it is sometimes very difficult to bring into contact. Also, it is an inconvenience which may easily be avoided by taking the precaution to dissect the skin to the extent of two inches, and of reversing it back upon its outer surface, in place of confining ourselves to the division of the cellulous bridges which unite it to the aponeurosis, as in the process of Desault. I have seen M. J. Cloquet unable to effect immediate reunion, in consequence of having neglected this precaution at the Hospital of Perfectionnement, in the case of a young man in whom he had been compelled to amputate the thigh at a short distance from the great trochanter; and the same thing has happened to me from not having been enabled to observe this rule in a similar case.

d. Fourth Stage.—The arteries that are to be tied or twisted are the femoral, the great anastomotic, and some branches of the articular arteries, or of the last perforating artery below. Their number increases the higher up we go; so that above we have, moreover, the profunda, the superficial muscular arteries, and some branches of the circumflex arteries, and of the obturator and ischiatic. With the view of facilitating the discharges, the French surgeons give such direction to the wound, that one of its angles looks forwards, while the other is turned directly backwards. Some practitioners of Great Britain censure this mode, because, say they, the posterior angle of the wound must necessarily in this manner, press upon the cushion or mattress. Hennen, among others, recommends that the tissues should be approximated from before backwards, and a transverse direction be given to the wound. But, without being absolutely essential, the French method is evidently the best. In respect to the position of the stump after the dressing, I have only to refer to what I have said on this subject farther back. I will only remark that it is difficult to give to its wound an inclined position. For it would be necessary for that purpose when the patient is in bed, to make a degree of extension which might be injurious, and which the natural action of the psoas and iliac muscles would render very fatiguing, if not impossible. Instead of a thick cushion, therefore, I place under the end of the stump only a sim-

ple folded alêze, (folded linen, see Vol. I.) with the expectation, also, that the inferior angle of the wound will occupy a more favorable position.

If the torsion of the arteries, which I have sometimes adopted, or the suture which I have made trial of but in one case, would procure a reunion without suppuration, they ought to be resorted to ; but this result has not yet been proved up to the present time. A child has been cured, it is said, in eight days. In a patient of M. Serre, (*Gaz. Méd. de Paris*, 1836, p. 826,) nothing remained on the tenth day but a *few points* in a state of suppuration. All this, however, does not furnish conclusive evidence. The cure of one of my patients, treated by simple approximation, was effected on the twenty-second day ; others were almost entirely restored (*n'avaient presque plus rien*) on the sixth, eighth or tenth day ; notwithstanding which, the greatest number were not entirely well until at the expiration of a month or two !

II. *Flap Method*.—Inasmuch as circular amputation, by the modern processes, when properly performed, generally admits of the lips of the wound being brought together with facility, and of immediate reunion, it has not been thought necessary to make as varied trials of the flap method above as below the knee. Notwithstanding the advantages that Ravaton, Vermale, Le Dran and Desault say they have derived from it, and the successes that Paroisse had from it on the field of battle, and although the seven cases that Klein speaks of were almost entirely restored in the space of ten days, and that M. V. Mott and many other surgeons, German as well as English, have also made trial of it with advantage in these latter times, it is, notwithstanding, but very seldom employed. An objection made to it is, that it is more painful and tedious, which, however, is far from being demonstrated ; also, that it requires a greater extent of sound parts, which assertion, as it appears to me, has some little more foundation ; and that it exposes to more serious general accidents which, perhaps, so far as this last point is concerned, may also be somewhat true. I tried it but once ; the bone escaped from the upper angle of the wound, and the patient died. Some surgeons, as M. Guthrie for example, who, moreover, prefer the circular method, nevertheless have recourse to the flap process where it becomes necessary to amputate the thigh at its upper third ; it offers, in such cases, unquestionable facilities for the approximation of the lips of the wound.

a. Process of Vermale.—Nothing at the present time would induce any one to employ the 3 incisions of Ravaton, to obtain the flaps that we may require. It is infinitely more simple to plunge the knife at first through the thickness of the limb, as has been recommended by Vermale. The patient and the assistants being arranged as has been already described, the operator places himself outside for the right limb, and inside for the left, which position, however, could in a case of necessity be reversed ; he then grasps the muscles with his left hand and draws them more or less from the bone, plunges in a long knife, so that it may fall upon the anterior surface of the

femur at some lines below the point where he wishes to make the section; he now slightly inclines the point of his instrument so that it may graze the outer side of the bone; and immediately after directs it in such manner that it may come out from behind at the point diametrically opposite to that at which it entered; he then cuts from above downwards, and from within outwards, in order to form his outer flap, to which he gives a length of from three to four fingers breadth, and which an assistant immediately raises up. The knife being brought back to the anterior angle of the wound, pushes aside the tissues on the side of the axis of the body, glides upon the inner surface of the femur, reaches behind the bone, and in order not to cut the soft parts posteriorly a second time, the surgeon crowds them back and separates them towards the inside; he in this manner cuts out a second flap of the same form and of the same length as the first.

If we should adopt the ideas of Heunen, and wished to give a transverse direction to the wound, the flap method would in no way interfere with it; in that case all that would be necessary would be to place one of these flaps behind and the other in front, instead of making them on the inside and outside of the limb. I should prefer commencing with the outer flap, for the reason that from there being less of soft parts there, it is important to draw them to that part as much as possible, in order that there may not be too great a difference in the thickness of the two halves of the wound, and especially because we could in this manner dispense, if necessary, with compressing the artery at the inguinal space, since it is not divided until at the moment when we are terminating the flap.

b. Process of M. Langenbeck.—In place of cutting out the flaps by puncture from the deep-seated parts to the skin, M. Langenbeck divides the tissues from the integuments to the bone. He places himself on the inside for the right limb, and on the outside for the left limb, unless he makes use of his left hand; he then causes the skin to be drawn forcibly back by an assistant; seizes himself the knee with one hand, and with a knife of medium length cuts with a single stroke all the soft parts which cover the inner side of the femur, from below upwards and from the superficial parts to the deep-seated, in such manner in fine that his instrument arrives upon the bone only, at three inches above the point where he has begun his incision upon the integuments. An assistant raises up this flap. The operator now directs his fore-arm behind, then outside, and then in front of the thigh, and cuts upon the outside a flap similar to the first, taking care that the extremities of the half moon that it forms shall coincide with the angles at the base of the inner flap.

c. In both these processes it will be necessary, after having raised up the two flaps, to apply the instrument near their root, in order to detach any remaining soft parts that may be still adherent to the bone, and to be enabled to apply the saw a little higher up on the bone than where the point of the instrument first struck.

It is evident also that we could get along very well with a single flap, either on the inside or outside, in front or behind, if the state

of the parts were such as not to allow of our cutting a second one in the opposite direction; and that all the details of the flap amputation in general are precisely applicable to that of the thigh in particular. M. Bancel, (*Thèse, Strasbourg, 1806*), who says he has followed in every point the process of Vermeil, declares that he has performed it successfully more than sixty times. M. Hello, (*Thèse citée*), who, after the example of M. Foulloy and that of M. Plantade, (*Thèse, Montpellier, 1805*), had recommended it before them, restricts himself to a single flap cut at the expense of the soft parts anteriorly, and maintains with reason that his process has the advantage over all others of making the most effectual resistance to the sally of the bone, inasmuch as the fleshy masses are drawn by their own weight upon the whole extent of the wound. I doubt, however, if the circular method properly performed is not still preferable to all those modifications which ought not to be retained, as it appears to me, but for cases that are exceptions. If I employed it, I should cut out a larger anterior flap and a smaller posterior one, instead of obtaining them on the side, and would thus deprive the bone of the power of protruding through one of the angles of the wound. If the disease should render it necessary to make the section of the bone on a line with or very near the trochanters, as in the patient of Knox, (*Edinb. Med. & Phys. Jour.*, Vol. XVIII.,) or that of M. Develey, (*Thèse de Paris*), and as I have myself twice done, the flap method might have its advantages; but then it is a matter of less importance whether the flaps should be made in one way rather than another, as it is the condition of the soft parts which would be the surgeon's guide.

C. At the thigh the stump requires *subsequent cares*, which surgeons perhaps do not sufficiently attend to. In many cases nothing more is done than to place a cotton cap upon it; others cover it with compresses or flannel. M. Thomas, (de Revigny,) in order to keep the flesh under the end of the bone, has contrived a sort of blowse (blouse) of linen, which answers its purpose sufficiently well. He moreover arranges at the bottom of the cuish, (cuissart,) under the cushion which is to support to a greater or less extent the stump, a sort of wadded spring, (ressort à boudin,) which he much extols, and has very often applied to the drum-stick of numbers of persons for a long period back amputated by him at different places.

This spring which had already been used to raise up the heel in shortening of the leg, and of which M. Champion has transmitted me a pattern, would answer equally well for the supplemental bootikins [or buskins] for the foot.

[*Modification of the Circular Operation in Amputation in the Continuity of the Thigh.*—M. Le Sauvage, of Caen, (Sitting of the Academy of Medicine, Paris, March 22, 1842; *Journ. des Conn.*, &c., of Paris, Mai, 1842, p. 215–216,) has proposed a modification of the circular operation in amputation of the thigh, which appears to us to be very judicious, and one that it is truly surprising has not suggested itself before. It consists in the mode of making the

section of the bone. After having drawn the soft parts as far back as can be done by the split compress, in order to denude the bone as much as possible, he directs his saw in such manner as to give an *ovalar surface* to the end of the bone, looking obliquely forwards. By this means, we avoid the irritation of the sharp angles of the straight transverse section, and the void they necessarily make; and the special advantages we obtain are the better adaptation and more ready adhesion (without suppuration) of the middle of the triceps muscle and the other soft tissues to this large smoother surface of the end of the femur; whereby there is less danger afterwards of protrusion of this extremity from the stump, and of rupture of the cicatrix. T.]

§ II.—*In the Contiguity.*

A. *History.*—Morand (*Opuscules de Chir.*, t. I., p. 176) appears to have been the first who entertained the idea of amputating the thigh at the joint, and conceived the possibility and success of this formidable operation. Two young surgeons, Wollher and Puthod, (Morand, *Opusc.*, &c., p. 176,) who had been his pupils, made a formal proposal of this kind to the Academy of Surgery, on the 3d of March, 1739, and obtained, on the 26th of July, 1740, a favorable report from Le Dran and Guérin the younger. Ravaton (*Chir. d'Arm.*, p. 323–26) would have performed it in 1743, if his brother surgeons, called in consultation with him, had not been opposed to it. On the 7th of March, 1748, Theroulde sustained a thesis of Labourette on this subject, and which theme Morand succeeded in getting submitted to the *Concours* for the year 1756, and again, in 1759, the Academy not having on the first occasion found any memoir worthy of the prize they had proposed. They received thirty-four memoirs, and gave the prize to that of Barbet. Goursault, Moublet, (*Journal de Vandermonde*, t. II., p. 240, etc.) Lefebvre, Puy, and Lecomte, also, each published a treatise on disarticulation of the thigh. Almost all of them agreed that it was practicable—some from trials made on the dead body, others from experiments on dogs; while Barbet (*Acad. Roy. de Chir.*, t. IV., p. 1) reasoned thus, from analogy and from the fact that a child of fourteen years, attacked with gangrene from ergoted rye, and who had been amputated in this manner by Lacroix of Orleans, in presence of Leblanc, first on the right and four days after on the left thigh, appeared to be on the point of recovering, and did not die until fifteen days after the first operation.

Perault of Saint-Maure, in Touraine, felt obliged to imitate Lacroix, in 1774, upon a patient named Gois, who had the thigh crushed between a wall and the tongue of a carriage, and afterwards destroyed nearly as high up as the hip by the progress of gangrene. This patient, whose history is given by Sabatier, (*Méd. Opérat.*, t. IV., p. 542,) recovered, and was for a long time a cook at an inn at Sainte-Maure, where I saw his son in 1815. Kerr, according to M. S. Cooper, (*Dict. de Chir.*, etc., p. 85,) performed the same operation nearly about the same time, on a young girl aged fourteen

years. Perhaps the case ascribed to R. H. Toll, by Sprengel, (*Histoire de la Méd.*, t. VII., p. 331,) is the same as that of Kerr. M. Delaunay (*Bull. de la Fac. de Méd.*, t. VI., p. 197) states that he saw the case of a man at Moscow, whose thigh was disarticulated by gangrene, and who got well.

Pott and Callisen having severely censured this operation, and Bilguer, Tissot, &c., in vain defended it, there was scarcely longer any mention made of it in England and Germany, at the beginning of the present century. It was in the French armies, however, that it was put sufficiently to the test. A. Blandin gives three examples of it. He performed the operation on the first of these cases, in the month of Fructidor, an III., and effected a perfect cure. The second was also saved, and the third did not die until on the fifty-eighth day. M. Perret, another military surgeon, had the good fortune, about the same time, also to succeed in a case. So also Mulder, in 1798, on the case of the girl named Wiertz, aged eighteen years; while Rossi says he saw (*Clin. Chir.*, t. III., p. 616) a case that recovered after spontaneous disarticulation. At the year 1803, M. Larrey had already several times disarticulated the thigh, and his memoirs relate two well-ascertained successes: one on a Russian at Witepsk, and the other on a French soldier at Mojaïsk. According to M. Gouraud, Dr. Millengen had two similar successes, and had published them at London. M. Baffos (*Bull. de la Fac. de Méd.*, t. III., p. 71–112) was the first who performed extirpation of the thigh at Paris, which was in 1812, at the Hôpital des Enfants, on a child aged seven years, who recovered from the operation, though the cotyloid cavity was diseased, but died from the progress of the scrofulous affection at the expiration of three months. A soldier wounded at Merida and operated upon by M. Brownrigg, in 1812, recovered so perfectly that he returned to reside in England, where many persons have since seen him. (*The Cyclopædia of Practical Surg.*, p. 182.) M. Guthrie succeeded in the same operation upon a French prisoner, whom M. Larrey exhibited in 1815, (*Bull. de la Fac. de Méd.*, t. V., p. 510,) and who is now at the Invalides. Another successful case in France was that of Delpech, (*Arch. Gén. de Méd.*, t. XVII., p. 301;) a third and afterwards a fourth, in England, viz., by M. A. Cooper in the year 1824, and by M. Orthon in 1826. M. Mott, (*Philad. Journ. Med. & Phys. Sc.*, vol. XIV., p. 101,) in 1827, published a fifth case, and M. Wedemeyer (*Bull. de Férussac*, t. II., p. 165) a sixth. The patient of M. Syme (*Ibid.*, t. IV., p. 143) was cured by the thirty-fourth day. The one that M. Brice operated upon in 1825, and who came near perishing from hemorrhage, was seen by this surgeon, some months after, at Poros, in perfect health, as was also that of M. Hysern, seen by him, three years after, at Barcelona. M. Mayor's case (*The Cyclop. of Pract. Surg.*, etc., p. 182) also recovered. A soldier, who had been operated upon in Africa, had been a long time cured when he was exhibited, by M. Baudens, (*Bull. de l'Acad.*, etc., t. I., p. 324,) to the Academy of Medicine.

B. *Appreciation.*—At the present day this operation which, less than fifteen years ago, M. Richerand scarcely admitted to be prac-

ticable, counts more than twenty perfectly authentic cases of success. But how often has death also been the result ! MM. Thomson, Kerr, A. Blandin, A. Cooper, Brooke, Cole, Walther, (*Journ. de Chir.*, t. VI., p. 1,) Larrey, Guthrie, Emery, Dupuytren, Blicke, Krimer, (*Bulletin de Férussac*, t. XVIII., p. 80,) Brodie, (*Cyclop. of Pract. Surg.*, etc., p. 182,) Gensoul, (*Lanc. Franç.*, t. II., p. 220,) Clot, (*Ib.*, t. IV., p. 96,) Roux, (*Arch. Gén. de Méd.*, t. XV., p. 467,) &c., have each had the misfortune to see at least one of the patients on whom they had performed this operation, perish. The second case operated upon by Delpéch, (*Ibid.*, t. XVII., p. 301,) died at the expiration of two months ; and that of M. Carmichael, (*Cyclop. of Pract. Surg.*, p. 182,) died on the fifth day. One of those of M. Pelikan (*Graefe and Walther, Journ.*, etc., t. XIII., p. 510) died on the tenth day and the other on the sixtieth, (*Journ. des Progrès*, t. II., p. 229, 2e série.) The case of M. Dieffenbach, (*Bull. de Férussac*, t. XII., p. 237,) survived only ten hours. I have performed the operation twice, and both patients died, one on the third and the other on the fourteenth day. M. Sédillot, (*Gaz. Méd. de Paris*, 1833, p. 923,) M. Blandin, (*Journ. Hebd. Univ.*, 1835, t. IX., p. 369,) M. Gerdy, (*Bull. de Thér.*, t. VIII., p. 318,) and M. Vidal, which last I assisted, have not been more fortunate, and it would be too easy to multiply at the present day similar examples. The two patients operated upon by Kerst both died, and Dupuytren has told me that he had had the same misfortune in three of his cases. M. Larrey, however, seems to give it the preference even in cases where it would be practicable to make the section of the bone between the articulation and the little trochanter.

I am fully of his opinion in this matter. The cases that have occurred in my own practice, and the two amputations of this description that I have had an opportunity of examining, have satisfied me conclusively that he is right. My patients were in such a state of exhaustion when they desired to be operated upon, and the disease had made such progress towards the pelvis, that I can scarcely comprehend how they were enabled to support such lesions even for a few hours. Those of Barbet, Kerr, Baffos and Delpéch, died in consequence of the progress of their primitive affection, and not from the effects of the operation. In the other cases the disease was of so serious a character that a pure and simple amputation of the thigh, had it been allowable, would probably have had the same result.

Therefore a comminuted fracture, a necrosis, caries, osteo-sarcoma, spina ventosa, or any incurable degeneration whatever, of the femur, extended above its shaft, or gangrene, or any other disease in fact which has progressed nearly as high up as the haunch, and which is of such serious character as to demand amputation, will claim disarticulation provided the cotyloid cavity and the bones of the pelvis are not affected. Wounds from fire-arms, with lesion of the bones in the upper third of the thigh, are the circumstances under which it is most decidedly indicated. As it then becomes important that the instrument should be carried to some distance above

the disease, I cannot see why we should hesitate to make trial of it. The reasoning and the facts already known on this subject, induce us to believe that, other things being equal, it is not more dangerous than amputation at the most elevated fifth of the femur. Its execution is more easy and infinitely more prompt; nor is the wound much larger. We divide the same muscles and the same vessels, and there is no need of so much tissue to effect coaptation. Let it be performed under circumstances less desperate, and I am convinced it will give a reasonable proportion of cures, (See *Excision of the Head of the Femur*, infra.) [It is thus seen that Professor Velpeau fully coincides in opinion with Baron Larrey against the proposition of Mr. Syme, who would always amputate rather at the trochanters than disarticulate the femur. See note on Mr. Syme's views below. T.]

C. *Anatomy*.—The head of the femur constituting more than a hemisphere, is so enveloped in its fibrous capsule that it will continue there as if strangulated in it, unless its section has been made near the cotyloid border. It is this, doubtless, which induced M. Weber (*Arch. Gén. de Méd.*, 2e série, t. XII., p. 238) to think that it is kept in its place by atmospheric pressure. The circumference of its transverse plane (plan) on which rests the axis of the femoral neck, obliquely outwards, downwards and slightly backwards, being about to be exposed to the action of the instrument at the moment of the operation, the surgeon must not lose sight of it. The arrangement of the internal ligament is such that when stretched by the head of the femur upon our reversing the limb outwards, it will almost present itself spontaneously to the cutting edge of the bistoury. It is true that when we commence on the outer side of the joint, it is found relaxed in proportion as we incline the thigh inwards; but as it in no manner interferes with the luxation of the bone, we may divide it with great ease upon the inner side of the cotyloid cavity.

The coxo-femoral articulation, covered outwardly by the psoas and iliac muscles, and slightly by the rectus femoris, and on the inside by the pectineus muscle and the vessels and nerves, is more superficial in front than in any other place, and corresponds here to the union of the middle and outer third of Poupert's ligament. Behind it is separated from the integuments by a space of considerable size, which is filled up by the third adductor, quadratus femoris, semitendinosus, semi-membranosus, biceps, obturators, gemelli, and pyramiform muscles, together with loose or adipose cellular tissue, the great sciatic nerve and some vessels. A triangular notch filled up by the glutei muscles and *fascia lata*, bounded by the great trochanter below and by the external iliac fossa above, separates its outer side from the skin, while the great trochanter itself is almost naked under the integuments. Upon its inner side is observed a kind of gorge formed by a concavity upon the femoral neck, which descends to below the little trochanter, and which is filled up by the principal mass of the adductor muscles and the gracilis, the terminations of the psoas and iliac muscles, and of the pectineus, all which obliges

us to look for the capsule upon a plane much more nearly approximated to the symphysis pubis, and one much higher up than the axis of the limb would seem to indicate.

A point not to be neglected in a case of embarrassment would be the lines drawn from the antero-superior spinous process of the ilium, from the great trochanter or crest of the pubis, to measure the distance which separates those different points from the articulation; but the above directions will usually answer for the surgeon grounded in anatomical relations. The great and little trochanter, even the head of the femur continuing in a state of cartilage up to the age of ten or fifteen years, could, if necessary, be divided in young persons by the knife if it should prove difficult to get round them at the time of the operation. The anomalies which may be presented by the cotyloid cavity, the tuberosity of the ischium, the neck of the femur, and the projections which are around its base, have scarcely any other relation than to the length, prominence or direction of these different objects; consequently they very rarely present any real difficulties at the moment when the instrument is in the act of disarticulating the thigh.

D. Operative Process.—I. Circular Method.—a. English Process.—Abernethy appears to have been the first who conceived that the amputation of the thigh at the joint could be performed by the circular method. This surgeon first causes pressure to be made upon the artery on the body of the pubis, then incises the skin, and afterwards the muscles at some inches below the articulations; then separates the muscular tissues from the great and little trochanter, divides the capsule, luxates the bone, cuts through the inter-articular ligament, removes the limb, ties the different arteries, and finishes by bringing together the lips of the wound from before backwards, and keeping them in contact by strips of adhesive plaster.

M. Colles is not the only person who has employed the method of Abernethy on living man. M. Krimer has also followed it. Dr. Weitch, who also prefers it, before looking for the articulation, lays bare the femur downwards, to the extent of two or three inches below the incision of the soft parts, in order to make use of it afterwards as a lever to disengage the bone from its socket; a precaution, however, altogether useless, for it is always practicable, after dividing the capsule, to move the limb in this or that direction, with all the force that may be required.

b. Process of M. Graefe.—Circular amputation is also eulogized by M. Graefe, who uses it, in fact, for almost all disarticulations. As at the shoulder, so at the thigh, he makes use of his large knife to divide the tissues, entering with it from below upwards, and moving it in such manner from the skin to the head of the bone, as to dig out as regular a hollow cone as possible. Having noticed that the head of the femur was sometimes difficult to enucleate, (*déboiter*,) M. Graefe advises that the cotyloid border should be divided upon the notch of the same name; but if the operator takes care to divide the fibrous capsule accurately upon the largest circle

of the articular head, as I have pointed out, he will have nothing to fear from this inconvenience, which, according to M. S. Cooper, presented such difficulty to a celebrated practitioner of London, that he was for half an hour at work in disarticulating the bone.

II. *Flap Method*.—The flap method has been almost always preferred for this amputation. A multitude of different processes, moreover, have been devised for this purpose. I will not notice those of Ravaton, Moublet and Petit-Radel, because they are too complicated or too difficult. Barbet, Perault, and M. Baffös, having only been called upon to finish, so to speak, what nature had begun, have consequently had no particular method of proceeding to be described.

a. *Process of Lalouette*.—We find described in a thesis under the presidency of Lalouette, who was a relative of Le Dran, one of the best processes that can be employed. This consists, says Louis, who describes this mode of proceeding, and which was adopted also by Gouraud, Puy and Lecompte, in commencing with an incision nearly semicircular upon the outer part of the thigh, so as to disarticulate the femur before all other things, and then in finishing with the section on the inside in such manner as to leave a flap of four to five fingers' breadth.

The following is the manner in which it is described by Theoult, (*Thèse de Haller*, t. V., p. 265, on Trad. Franç., t. IV., p. 45 :)—A tourniquet compresses the artery; the patient is placed upon the sound side; the operator makes a semicircular incision, which begins above the great trochanter, terminates at the tuberosity of the ischium, and penetrates down to the joint. He then, while an assistant brings the limb inwards, opens the capsule with a second stroke of the knife, luxates the femur, divides the remains of the capsule, grazes the neck of the bone, and terminates by cutting a flap on the inside of greater or less extent, according to the greater or less degree of emboupoint of the patient. M. Lenoir, (*Jour. Heb'd. Univ.*, t. V., p. 205,) who extols this method, effects compression upon the artery by means of the hand of an assistant, who, as soon as the articulation is divided, presses against the vessel with his thumb in the thickness of the tissues.

b. *Process of M. Plantade*.—Many persons have thought that it would be more advantageous to place the flap wholly in front rather than on the inside of the thigh. M. Plantade, who was one of the first to broach this idea, viz., in 1805, proposes that we should cut out the flap by means of three incisions in the same way as for the scapulo-humeral flap of La Faye, that we should divide the articulation on its antero-internal surface, and terminate by making a very small flap behind.

c. *Process of M. Manec*.—In April, 1831, M. Manec showed me on the dead body, the manner in which he had modified the process of M. Plantade. The knife being directed to the middle of the space which separates the spine of the ilium from the great trochanter, is carried from above downwards, and from without inwards, between the muscular tissues and the antero-internal sur-

face of the femoral neck, so as to come out in front of the ischium, and immediately form a large flap, whose free semilunar border looks downwards and outwards. An assistant immediately grasps this flap, and raises it up, taking care at the same time to compress the artery, unless we should prefer to apply the ligature to it before proceeding farther. In terminating, M. Manec divides the outer and posterior soft parts, by the semicircular incision of Moublet and before disarticulating, or he first divides the joint, and does not divide the soft parts till the last. This last method, which M. Maligne attributes to Bécларd, and which M. Robert has systematized, (*régularisé*), is one of the best. M. Lenoir, who adopts the first stage of this modification, proposes, and with good reasons, as it appears to me, that after the formation of the flap, we should always terminate the section of the soft parts, as if we were performing the circular amputation, and before we proceed to the disarticulation.

d. Process of M. Ashmead.—M. Ashmead, a surgeon of Philadelphia, also communicated to me in April, 1831, a process founded upon the same idea as the preceding. Like M. Manec, he gives the semilunar form to his flap, and like M. Plantade, he cuts it from the skin to the deep-seated parts. After having made the incision into the integuments on the region indicated, he raises them up a little, in order to lay bare the artery and tie it. Indifferent as to the hemorrhage, he proceeds to the section of the muscles, reaches the capsule, disarticulates the femur, and finishes like M. Plantade or M. Manec.

e. Process of Delpech.—A process, which gives a result almost the same, in every respect, as that of Lalouette, is that of Delpech. This professor first ties the femoral at its emergence from the crural arch; then cuts an inner flap by plunging a narrow one-edged knife from before backwards, between the gorge of the femur and the soft parts, directing it downwards towards the skin, and with greater or less rapidity. This flap being formed, is grasped and raised up by an assistant. The operator then gives a semilunar shape to its base, comes down upon the inside of the articulation and divides the fibrous capsule and inter-articular ligament; he then causes the thigh to be placed in its natural position, makes a semicircular incision below the external iliac region, unites in this manner the anterior and posterior extremities of the base of the flap, and makes a little nearer the great trochanter the section of the three glutei muscles, the obturator internus, the pyriformis, the gemelli, and the outer side of the capsule. Nothing remains but the arteries and the dressing. Delpech maintains, that with a single flap immediate union is more easy and certain. A gentle pressure, says he, easily induces the fleshy tissues to mould themselves to the cotyloid cavity, which prevents inflammation, suppuration, exfoliation of the cartilages, and fistulas. Moreover, as his flap presents a very long, oblique cut, he prefers that upon the outside the section of the integuments should be somewhat more elevated than that of the other parts, in order that there may not be too much skin, and that

the coaptation, which he also favors by means of the suture, may be more perfect.

f. Process of M. Larrey.—Le Fébure, who wrote to Louis about the year 1760, to inform him of the result of his researches, had already proposed to tie the femoral artery in the fold of the groin before commencing the operation. M. Larrey has made a precept of this precaution, which, he says, allows the surgeon to proceed with greater security, and saves an infinite deal of risk to the patient. The artery being tied, and the operator placed on the outside of the limb, directs the point of a long knife to a spot about two or three fingers' breadth below, and within the antero-superior spinous process of the ilium, so as to fall directly upon the anterior surface of the bone; he then inclines it a little inwardly, glides it along the inner side of the neck of the femur, and thus continues to direct it backwards, until it cuts through the skin in the subischiatric groove; he then cuts out an inner flap about four inches long, in the same manner as Delpech; raises up this flap, and then divides the capsule to the extent of half its circumference at least, and very near the cotyloid cavity, as if he were about to pass transversely through the middle of the head of the femur without attempting to enter the articulation; then places the limb in abduction, luxates it, and stretches and divides the internal ligament; passes his knife upon the outer side of the articular head, and completes the section of the capsule; arrives at the tendon of the glutei muscles, and behind the great trochanter; inclines his knife flatwise, grazes the outer surface of the body of the bone, and makes a second flap as much like the first as possible. All the arteries being tied, the two flaps are brought into coaptation, taking care to leave the ligatures in the posterior angle of the wound, which serves as a filter to the discharges.

M. Larrey (*Clin. Chir.*, tome III., p. 613) has since described *another process*. The artery being tied, he cuts the skin circularly, makes an inner and outer flap, disarticulates, and then finishes by dividing the attachment of the glutei muscles.

g. Process of A. Blandin.—It appears that when M. Larrey published his method in 1803, the process with two flaps had long been in use with military surgeons. That which Blandin had successfully employed in 1795, consisted in first tying the artery, and making a first flap as M. Larrey does; but instead of continuing from within outwardly, like the last-mentioned surgeon, A. Blandin cuts his outer flap before attacking the capsule, or proceeding to disarticulate.

h. Process of M. Lisfranc.—M. Lisfranc (*Arch. Gén. de Méd.*, t. II., p. 161) makes use of a narrow knife with a double cutting edge; plunges it in from before backwards, and outside of the neck of the femur; goes round the great trochanter, and thus begins by forming an outer flap of three to four inches long; brings back the instrument to the upper angle of the wound; inclines its point a little inwards to glide upon the gorge of the bone; then immediately elevates the handle; draws the fleshy tissues inwards, in

order that the knife may, without again touching the integuments, strike below the ischium; he then cuts all the tissues without leaving the femoral bone, until he encounters the little trochanter; he now goes round this osseous projection, and directs an assistant to grasp the root of this second flap by introducing his thumb into the wound, and thus compressing the artery; and finally terminates the section of the soft parts on the inside the limb, (*parties molles internes*), as M. Larrey does; and ties all the vessels, and then proceeds to the disarticulation.

i. Process of Dupuytren.—The surgeon places himself on the inner side of the limb, and if he is ambidexter, makes use of the right hand for the right limb, and the left for the left limb; draws back the integuments towards the pelvis, himself supports the thigh, and inclines it more or less in flexion, extension or abduction; then makes a semi-lunar incision on the inside, with convexity downwards, and which commences near the antero-superior spinous process of the ilium, and terminates near the tuberosity of the ischium; at first, he divides only the skin which is immediately drawn back by an assistant; forthwith divides the muscles in the same direction, and thus cuts out an inner flap from four to five inches in length; this he causes to be raised up, and he then attacks the capsule in the same manner as M. Larrey, cutting through the articulation, and terminating with his outer flap. The successful issue in the case of M. Hysern, is due to this process.

j. Process of Bécclard.—Placed outside the hip-joint, Bécclard commences with cutting an outer and posterior flap, by plunging in his knife obliquely from without inwards, and from before backwards, from the neighborhood of the iliac tubercle to the inner extremity of the sub-ischiatric groove, grazing as he proceeds the posterior surface of the neck of the femur. A second flap is to be formed in the same manner in front, and the operator finishes with the section of the capsule and the disarticulation. With Dupuytren and Bécclard, the artery was secured only by making pressure upon it on the pubis.

k. Process of M. Guthrie.—Two semi-lunar incisions, the one inside and in front, the other outside and behind, and extended from the neighborhood of the spine of the ilium nearly down to the tuberosity of the ischium where they united, characterize the process of M. Guthrie. This surgeon cuts through the integuments with the first stroke, and then causes them to be raised up; he then reapplies the knife on a line with the retracted skin, in order to divide the muscles obliquely from below upwards; thus arrives upon the joint after having formed two flaps, and finishes like A. Blandin, Abernethy and Bécclard. It is evident that the process of the English surgeon differs from that of Bécclard, only in dividing the tissues from the skin to the bones in place of dividing them from the deep-seated to the superficial layers; but it is precisely in this particular that it has in reality some advantages.

l. A large flap on the inside, and a small one on the outside.—In the process of M. Kerst, which serves as the base of that of M.

Manec, a knife with a double-cutting edge, is plunged from before inwards, and as near as possible to the articulation. Its point comes out behind; an inner flap is then cut out, of sufficient length to cover three quarters of the wound, and the articulation sometimes laid open by the same stroke. The thigh is placed in abduction, and the capsule and round ligament divided; the bone is then luxated, and the operation completed by cutting a small outer flap. The artery is compressed upon the pubis.

m. Process of the Author.—1. A postero-external semi-lunar incision upon a line with the great trochanter; 2. An antero-external incision for a cutaneous flap of two inches in length, which is raised up; 3. The section of the muscular tissues from before backwards; 4. The semi-circular section of the capsule near the cotyloid border; 5. Luxation and then division of the internal ligament; 6. Separation of the limb posteriorly.

III. *Ovalar Method.*—The ovalar method has not yet been applied on living man for amputation of the thigh at the joint, but in a very small number of instances; it is, however, the one which obtained for M. Baudens the successful issue to which I have referred in his case. The two modifications which it embraces, have been made trial of on the dead body, first by MM. Cornuau and Scoutetten, and afterwards by all the young surgeons who are in the habit of exercising themselves in our amphitheatres, in the manipulations of operations.

a. Process of M. Cornuau.—The patient is laid upon his sound side. The surgeon placed behind the hip, is first to make an oblique incision, which is to be carried from above the great trochanter backwards, outwards and downwards to below the ischium; a similar incision is made in front and upon the inside; then with a second stroke for each incision he divides the muscles as deeply as possible; attacks the articulation on its outer surface at the same time that the limb is placed in abduction by an assistant, and then divides the joint from without inwards as soon as the head of the femur is luxated. He then at last, while another aid raises the two lips of the wound, makes the section of the inter-osseous ligament, the inner portion of the capsule, and of all the soft parts on the inside which separate the two first incisions, or which form the base of the V and of the triangle which they had at first circumscribed.

b. Process of M. Scoutetten.—The operator first plunges in the point of his knife above the great trochanter; then depresses its handle a little in order to divide all the tissues as in the preceding method; then brings back the knife to the posterior extremity of the first wound, and returns upon the other side of the limb in order to unite this last incision with the apex of the first wound. If any tissues remain between the postero-internal part of the neck of the femur and the wound of the integuments, the operator divides them and then finishes with the disarticulation.

E. *Dressing and Relative Value of the Different Methods.*—In respect to these numerous processes I can only repeat what I have

already said on amputation at the shoulder. Almost all of them are of a character that render them applicable in practice; nor should any one of them be adopted exclusively. Nevertheless, as several of them are only very simple and natural modifications of the others, some of them in reality may conveniently be dispensed with without any disadvantage.

I. In the *circular method*, for example, which is incontestably the most disadvantageous, and which never should be selected except in cases where the degeneration of the integuments has involved the whole circumference of the limb nearly as high up as the hip, the process of Abernethy and that of M. Graefe, differ only in that of the German surgeon admitting more easily than the other of the union of the lips of the wound. The modification proposed by M. Weitch, has no other advantage than that of permitting us in cases of fracture to remove the limb first without proceeding to the disarticulation of its upper fragment until afterwards. A precaution which I would not neglect to take, would be to dissect and carefully turn back all the sound skin, in order to divide the muscles very high up and very near their origin, and to take as much of them away as possible.

II. The *ovalar method* is practicable every where, where that with two flaps would seem to be applicable. It makes a wound and flaps almost as regular as the circular method, offers no obstruction to immediate reunion, and enables us to fill up very accurately the cotyloid cavity. The two modifications also which it comprises have scarcely any advantage over each other. I should, however, prefer that the cutaneous layer should be divided lower down, and that of the muscles higher up than is recommended. We should thus be enabled to effect the approximation of the lips of the wound with greater ease, whilst inflammation, reaction and suppuration would be moderated in their intensity. By applying to the great trochanter after the manner of Ravaton and M. Malgaigne, (*Man. de Méd. Opér.*, p. 354,) the longitudinal incision which constitutes the point of departure in the process of M. Larrey in the disarticulation of the shoulder, we should obtain all that we could hope for from the ovalar method.

III. Among the *flap processes*, those which comprise two, become in some sort a matter of necessity, when it is possible to give them the same length, and when the soft parts are equally degenerated in every direction. In such cases the process of Dupuytren and that of M. Guthrie are preferable to all the others by the security of the operation, because they allow of our saving more skin than muscles, and because the flaps by being formed obliquely, and not on each side as in the processes of A. Blandin, and MM. Larrey and Lisfranc, fill up (*font disparaître*) more readily and more completely the cavity left by the head and neck of the femur and great trochanter.

IV. When the *outer flap* is cut in the manner of M. Larrey, it rarely happens that it does not present a notch on its lower border, and that it possesses a thickness which will correspond with that of the inner flap.

V. The method with a *single flap* should have the preference, where the soft parts on one side are degenerated and those on the opposite side sound. In such cases the nature of the diseases indicates in what direction the flap should be formed, and which should not be placed on the outside or posteriorly except where it is impossible to do otherwise. For the inside and front I should prefer the process of Lalouette to that of Delpech, and much better still one of the modifications recently proposed. The process of Lalouette, after the manner in which it is performed by M. Lenoir, gives a much more regular flap than that of the Professor of Montpellier; but this flap is too thick and not sufficiently large. That of MM. Ashmead and Manec is situated in such manner, that dragged down by its own weight, it falls over of itself, so to speak, upon the whole extent of the bleeding surface. By cutting it from the exterior to the interior, as M. Ashmead does, we are more sure of what we do; the ligature of the artery may be omitted, and we preserve more of the integuments than of the muscles.

VI. I proceeded in this manner with the two patients I have mentioned above. After having dissected up the skin to the extent of three inches in front and within, and made a semicircular incision outwards and backwards above the great trochanter, I proceeded to the section of the muscular tissues, and disarticulated from before backwards, without paying any attention to the artery, which an assistant kept compressed against the pubis; the operation lasted only half a minute.

VII. The *previous ligature* (la ligature préalable) of the femoral artery, as recommended by Lefébure, Moublet, A. Blandin and Brulatour, adopted by MM. Larrey, Delpech, Orthon, and Roux, and rejected by Abernethy, and MM. Baffos and Guthrie, [also used by Dr. Mott, T.] is, as we have said, another operation superadded to the principal one. Nevertheless, if in the flap method the compression upon the pubis, or, what is as well, by means of the fingers upon the root of the limb, as we may do in following the processes of Lalouette, M. Lisfranc, and Delpech, and even the ovalar method, should not give all the security desirable, the cutting down upon the femoral artery under Poupert's ligament is, at the present day, an operation performed with too much facility to prevent our commencing our incision at that point, in the event of our not being disposed to follow the recommendation of M. Ashmead.

Nor can I perceive, unless the patient is very much enfeebled, or the operation is going to be very long, how it can be indispensable, or even advantageous, to tie the other arteries before completing the disarticulation. The fingers of intelligent assistants, applied over them in proportion as they are opened, I have fully satisfied myself, are quite sufficient to allow us to proceed on and finish the removal of the limb without any apprehension. These arteries, moreover, are the obturator on the inside, the ischiatic externally and posteriorly, and then in front and also externally, some branches of the gluteal, or of the internal pudic; it will be necessary, also, if the previous ligature has been used, to tie the femoral ar-

tery a second time near the surface of the wound, as well as the profunda artery, in order to be enabled to effect immediate union of the little wound we have been obliged to make at first. M. Dubreuil (Tourette, *Essai sur l'Amputation de la Cuisse*, p. 18) mentions a patient who died of hemorrhage in the space of three hours, in consequence of having neglected to tie in this manner the femoral profunda; and he recommends that, to protect ourselves from such an accident, we should lay bare the femoral with the nail from below upwards, as high as under Poupart's ligament.

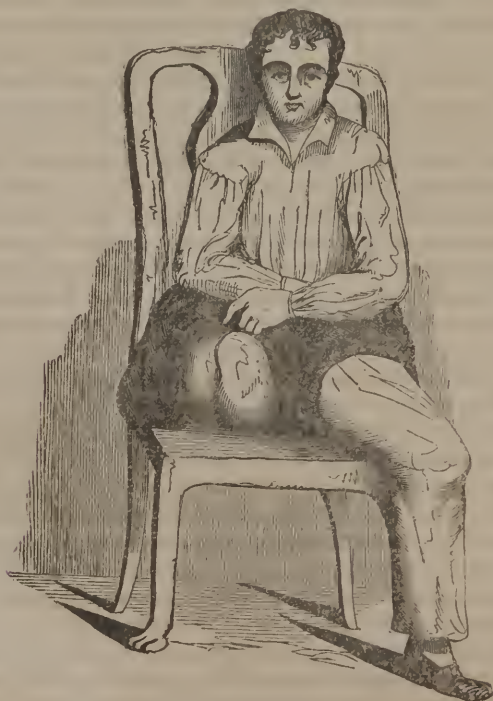
VIII. The necessity of placing into as perfect contact as possible the two sides of the enormous wound produced by the disarticulation of the thigh, is disputed by no one. The suppuration from so large a surface would soon cause the death of the patient by exhaustion, and would not fail to be accompanied by a violent general reaction. The suture, whose importance Delpech has endeavored to enhance, has several times been made use of, and we must confess that this is one of those cases which appear to be best calculated to justify its employment. It cannot, it is true, be applied without pain; but if the resource is useful, should a little more or a little less suffering influence us in the presence of such an evil? I would, however, remark, that it is not the wound of the integuments which it is especially important to unite, but on the contrary, that of the deep-seated tissues; and that it is to be feared, that, by means of the suture, the matters that might accumulate at the bottom of the wound would produce serious mischief before they could make their escape externally. The adhesive plasters, which have the advantage of causing no strangulation, readily allow, at the expiration of a few days, of our bringing the lips of the wound into more accurate contact than we had placed them at first, if the base of the flaps should appear to be properly united. Without, therefore, absolutely rejecting the suture, which is beginning at the present time to get into some repute again in the south of France, I am of opinion that we may in this operation, in fact, that we ought to dispense with its employment, except in those particular cases which the skilful surgeon will always know how to distinguish.

[*Coxo-Femoral Amputation; or, Disarticulation of the Thigh.*—M. Larrey, a very few weeks before his death, viz., as late as Jan. 3, 1842, (See Sitting of the Academy of Sciences of Paris, of that date, in *Journ. des Connaiss.*, &c., de Paris, Mars, 1842, p. 131,) upon the occasion of making a report as one of the commission on the memoir of M. Sédillot on coxo-femoral amputation, still persisted in the opinion which he had always entertained in favor of primitive amputation. He said the thigh could be amputated in its totality as well in acute as in chronic diseases, and that this amputation, where required, should be performed immediately after a wound, and not delayed; that M. Sédillot had exaggerated the dangers of sanguineous revulsions upon the viscera, as these could be overcome by general bleeding, cuppings with scarifications, &c.; and that, so far as regarded the danger of spasm from the section of the great

nervous trunks, this would be the same after the consecutive as after the primitive operation. M. Larrey considered that, in all cases, the chances of success would be greater if the ligature was previously placed upon the femoral artery at the fold of the groin, the value of which he had demonstrated in the course of his practice.

THE FIRST AMPUTATION OF THE HIP-JOINT IN AMERICA.—*Performed by Dr. Mott at New York, October 7, 1824. SUCCESSFUL AMPUTATION AT THE HIP-JOINT. By V. Mott, M. D., Oct. 7, 1824. (See Philadelphia Journal of the Medical and Surgical Sciences. Philadelphia, 1827, Vol. XIV., p. 101—104, with Plate.)*

It is now generally understood that surgical operations are not to be performed until all other curative measures have proved unavailing, or the life of the individual cannot be saved, unless some part be sacrificed for the preservation of the whole. We have, nevertheless, reason to rejoice, that even under exceedingly unfavorable circumstances, these dreaded resources of our art afford a rational prospect of success, frequently enabling us to arrest or re-



Mott's amputation at the hip joint. Appearance of the stump when perfectly healed.

move morbid affections, otherwise beyond reach of cure, and to prolong valuable lives in a state of comparative ease. Were we disposed to enter upon such an inquiry, it might be advantageous to determine how far the outcry against surgical operations, (doubtless just in numerous instances,) has proved detrimental to the interests of humanity, by causing the knife to be withheld in many cases where an intrepid and skilful employment of it would have been followed by the restoration of health, and the avoidance of the excruciating sufferings so often endured for a long time previous to the death of such patients. Without discussing this topic, however, we may be permitted to state our belief that a great number of persons are annually committed to the grave, because proper surgical measures are not enforced, and that these are as often withheld from timidity, prejudice, or ignorance, as from any valid objection.

Amputation at the hip-joint is an operation but seldom required, and always attended with great peril, both to the life of the patient and the reputation of the surgeon; but neither of these circumstances are sufficient to justify any one in asserting that this operation ought not to be performed, or that it may not in a majority of cases prove successful, if it be not too long deferred. The following case may prove serviceable to the profession, by showing that the operation may be advantageously attempted in a patient who would otherwise have speedily sunk under his disease. It is moreover interesting from the circumstance of its being the FIRST amputation at the hip-joint successfully performed in this country, as far as our present information extends.

George Byles, a healthy boy, ten years old, broke his thigh about two-thirds of its length from the hip-joint; two days after, splints and bandages were firmly, (and injudiciously) applied, which produced great distress, and were removed at the instigation of the boy. PHYSICK's modification of DESAULT's splint was prepared by the physician then called in, who pointed out to the father, previous to its application, a projecting point on the outside of the thigh, which was the extremity of the superior fragment, which, by the improper pressure was nearly forced through the integuments. The bone being properly coaptated, the long splint was then applied.

About three weeks subsequent to this period another physician was called in, who recommended the employment of the inclined plane, which was adopted, the boards forming it having pegs at the side. The boy stated that during his confinement to this inclined plane for several weeks, he had in tossing restlessly about, injured the thigh on the inside just above the condyle, which produced a sinuous opening leading to the fractured bone. It is most probable however, that the sinus was formed and pointing, when it was struck against the peg and opened.

He was brought into the city of New York on the 7th of September, 1824, at which time we first saw him. His countenance was expressive of much anguish, with a white tongue and feeble

pulse; his right limb was much enlarged on the outside, resembling a case of spina ventosa. To the touch it was hard and irregular, was exceedingly tender, and when pressed gave excruciating pain. The swelling extended to the great trochanter, gradually diminishing towards the top of the thigh. Opposite to the greatest enlargement was a sinus, discharging a thin sanious fluid, leading to the middle of the thigh bone, which was perfectly carious. During two weeks succeeding his arrival in the city, medicines were administered with a view of allaying irritation, and imparting tone to the system, but hectic and night sweats, notwithstanding, supervened. As ulcerations began to occur by the side of the tibia, and all the symptoms became worse, it was resolved to amputate at the hip-joint as the only chance of saving the life of the patient.

On the 7th of October, 1824, the patient, after having passed a comfortable night, was placed on the table in order to be operated upon. An incision was made over the femoral artery as it emerges from under the femoral arch, and the vessel secured by ligature. While feeling on the outside of the artery for the lesser trochanter, the pulsation of a vessel apparently but little smaller than the femoral artery immediately below the ligature, convinced us that in this case the profunda femoris was given off above the femoral arch, as we occasionally find it. This vessel was taken up.

Lisfranc's knife was then introduced between the artery and bone, and carried through close by the neck of the femur towards the tuber ischii, thus forming the inner flap. The external flap was formed by cutting from without inwards. The hemorrhage from the veins and small arteries was considerable when the incisions were made, and numerous vessels were taken up: but comparatively little blood was lost during the operation, and the patient was put to bed shortly after it was completed. After the inner flap was cut, some of the surgical attendants examining the lesser trochanter, pronounced that the head of the bone was *not diseased*. In order to satisfy the doubts expressed, the bone was sawed through the lesser trochanter, when it was found to be of the consistence of cheese, being denuded of periosteum on the outside up towards the joint, and requiring to be removed, which was afterwards done, as originally contemplated.

It is scarcely necessary for us to enter into the detail of symptoms and treatment subsequent to the operation, as nothing occurred worthy of note, except various degrees of irritation of the stomach and whole system, previous to the coming away of the ligatures. The treatment consisted in regulating the diet, and administering anodyne and tonic medicines according to circumstances.

On the 15th of October, eight days from the operation, two-thirds of the stump was healed by the first intention. Between the 17th and 31st of October, all the ligatures, seventeen in number, were removed; and by the 20th of November the whole stump was effectually healed, and the boy had become fat and lusty. There can be no doubt but that this limb might have been saved without

difficulty, had the proper treatment been instituted when the accident occurred. When it came under our charge, nothing short of the operation above related, could have saved this boy's life.

The appearance of the stump after the entire recovery of the patient, is very accurately represented in the engraving sketched by my friend, Dr. BELL, of New York; to Dr. FREDERICK KING, I am indebted for accurate notes of the progress of this case, which was under his especial care after the operation.

[CONSERVATIVE SURGERY TO SAVE THE LIMB FROM AMPUTATION.]

Among the great reformatations which the brilliant march of modern surgery may count as one of its greatest triumphs, is the introduction of what has not inappropriately been denominated, by Mr. Prior, of Woolwich Hospital, England, the *conservative* mode of treating compound dislocations and fractures of limbs, whereby the human body is saved from the deformity and mutilation of an amputation. Dr. Houston, of Dublin (*Lecture on Modern Improvements in Surgery*, Nov. 4th, 1844; *London Lancet*, Dec. 28th, 1844, p. 393, et seq.) correctly observes, that in regard to amputations, the greatest modern improvement is the *frequency* with which they are abstained from. Amputations, until very recently, we may add, were for centuries performed in the most reckless manner, and without the slightest attempt being previously made to save the limb, so that cripples on crutches from this cause, were to be seen everywhere. Sir Benjamin Brodie, in fact, states in the last edition of his work on "Diseases of the Joints," that he owes to this lamentable haste, (fortunate in its results to him and to science,) with which surgeons resorted to amputations while he was a young man, for white swellings, as soon as their character was determined, the minute knowledge he was thereby enabled to obtain of the true pathology of this disease, particularly in its earliest stages.

Our museums, says Dr. Houston, (*loc. cit.*, *London Lancet*, Dec. 28th, 1844, p. 394,) in this city, [Dublin,] likewise bear evidence of the same practice of early amputation; and, he quaintly adds, those who possess such preparations of disease will do well to take care of them, as they are not likely to get many other similar specimens from the hand of modern surgery. Which remarks, he says, apply also to extirpation of the mamma and testes, ulcers of the legs, hernia, injuries of the head, compound fractures, dislocations, &c.

In respect to operations, then, continues Dr. Houston, (*loc. cit.*) true surgery rather avoids than courts them; and in this respect, unlike what takes place in all other professions, the improvements introduced into it cause a diminution in the emoluments derivable

from the practice of surgery. It is a well-established fact, that the incomes of medical men are much reduced from this cause, and yet, nevertheless, they persevere with laudable disinterestedness in their endeavors to effect still further improvements. [See our note *supra*, on Compression in the cure of aneurisms by the Irish surgeons, in which we have expressed nearly the same thoughts, before having met with this lecture of Dr. Houston. T.] Is not this, says Dr. Houston, the highest degree of philanthropy? In this city, (Dublin,) more, perhaps, than in any other in the world, is this statement regarding the avoidance of unnecessary operations, true.

The diminution, he continues, of surgical operations in this city, is our highest boast; and I make it thus publicly, to contrast with one of an opposite character, which I have heard as having been uttered elsewhere, *for the ignoble purpose of attracting students to the schools*. And I do so still more especially, because I find that the records of the hospitals of Dublin have been pryed into, in order to make a case for the assertion of such a discreditable comparison. But although, in one sense, there is a judicious diminution in the number of surgical operations, in another, there is an increase. Many operations unknown in former days, are now in common practice.

We may state here, that discreditable practices like that mentioned by Dr. Houston, to depreciate the Dublin schools, are not, in our opinion, confined to that city. To declare, however, that a great metropolis, from its vast commerce with all parts of the world, its extensive class of laboring persons, and spread of the manufactures, arts, &c., all growing out of an immense trade, is far better adapted to a great surgical school, from the necessary frequency which must exist for operations in an emporium of this kind, is with this *caveat* what any such metropolis, or port, however, has a right to, and should promulgate, when contrasting its advantages to the student, over those of inland towns and villages—but no further.

In the inflammation which follows extensive destruction of the soft parts and bones in comminuted compound fractures, we must expect, during the progress of exfoliation, where that, and not re-consolidation of the detached fragments, takes place, to find exhausting and burrowing, fœtid, sanious, and purulent abscesses and discharges; over which ensemble of accidents, even where there are gangrenous sloughs also, and, as sometimes happens with the *tibia* under such circumstances, (P. J. Cabaret, of Angers, *Journ. des Connaissances Medico-Chirurgicales*, Paris, Janvier, 1844, p. 15, &c.,) a remarkably abundant and prolonged *discharge* also from the *medullary canal* of the injured bone, nature will, nevertheless, often completely triumph, as in the case alluded to, though a man aged 45, and enduring all the privations of extreme poverty.

M. Lemonnier, of Mortain, (Manche, France,) has effected a perfect cure by first intention, in a recent case under his care, (*Journ. des Connaiss.*, &c., April 1844, p. 151-2,) where more than one entire half of the *tibio-tarsal articulation* of the right leg was

opened in a young man, (a laborer,) aged 18, by the stroke of a hatchet upon the inner ankle. The parts were adjusted, and the teguments brought together by adhesive plasters, covered by lint and compresses, a long splint on the inside of the leg, reaching to below the plantar surface, and a bandage to prevent the deviation of the foot, the whole being kept moist, without, however, removing the adhesive straps, by decoction of marsh mallows and poppy. The outer dressings were renewed after every few days, without removing the plasters. At each time of dressing, there oozed from the wound a large quantity of purulent, fœtid discharge, of a coffee-ground color, which was shortly succeeded by a colorless liquid, of gluey consistence, resembling the white of an egg, (synovia.) The fœtor continued, and the surgeon now very judiciously kept the dressings wet with a weak dilution of chloride of soda. The plasters were removed successively as they became loose, and thus replaced by others. At the end of three weeks the wound improved, the pus became healthy, the granulations appeared, and the synovial discharge ceased. At the end of six weeks the pains had ceased, and the wound was healed; and three months after he could walk perfectly, and had all the natural movements of the foot, extension, &c., without any deviation.

This case certainly shows that we should not be too much in a hurry to amputate where the articulations are laid bare, especially where the wound is made by a clear smooth incision, and the constitution is good.

Two cases have occurred to Mr. Liston, of London, (*London Lancet*, Dec. 28th, 1844, p. 412, et seq.) both in young girls, one aged 17, the other 11, in which a tedious fistulous opening on the inner side of the heel, ending in *caries of the os calcis*, were cured by laying open the diseased part down to the bone, by a T incision on the side of the heel, dissecting up the flaps, and trephining and then scooping out the carious portion of the bone, and dressing from the bottom with dry lint to exclude the air, but with lotions externally, of *solution* of iodine, viz.:—Tinct. Iodin. ʒj., Iodide of Potassium, grs. x., and water ʒ viii. The new bone soon formed, and finally healthy granulations filled up the deep cavity, ending in a perfect cure. Mr. Liston has found that the tarsal and carpal bones thus vigorously treated, will often enable us to save the foot from amputation. The general treatment, also, must be generous, to aid the formative efforts of nature.

Mr. Shackles of the Leeds Infirmary, (England,) reports a highly interesting case (*London Lancet*, May 10th, 1845, p. 535) of a girl aged 16, who, caught in machinery, received a lacerated wound three inches long, outside the *right* patella, *penetrating into the joint*, and easily admitting the finger under the patella, with a large contused, lacerated wound also inside of the *left knee*, of which the integuments were much destroyed, the *vastus internus* muscle considerably lacerated, the *patella much ground down* as if rasped by a rough file, and with *an opening into the joint an inch and a half long*; the *synovia* also had escaped, and mingled with the exter-

nal coagulum. A large piece of integument hanging only by a shred, was detached, after which strips of dry lint were applied to the whole extent of the wound. Upon this dry lint, other strips dipped in *mucilage* were arranged in such way as to *completely prevent contact with the air*; outside the whole, a piece of oiled silk was placed. The same treatment for the wound of the other joint. Patient kept quiet on the back. The dressings were not removed until at the expiration of about eight days, when the suppuration began to show itself. After which, soft dressings were used. In about a month, the right knee was entirely well, and all its motions restored. In the other, the cicatrix did not finally heal for some months. The diet was generally nourishing, and attention paid to the bowels.

We thus see what can be done by occlusion of air, and mild, soft dressings, judiciously unaccompanied with any straps or bandaging to aggravate by their traction; so in the cases of Mr. Prior, which we speak of in our notes below. Yet, in former times, how readily would surgeons have adopted a different course, and then rendered *amputation* necessary, or have at least caused ankylosis. The success of this mild treatment of the joints, as in Mr. Prior's and other cases, are adverse to the too precipitate employment of hard, unyielding, stony encasements, like the starch bandage, at least in such wounds.

Mr. Jas. Prior, of the Royal Naval Hospital, Woolwich, relates the case (*London Lancet*, Dec. 21, 1844, p. 366, et seq.) of a laborer whose elbow joint, struck by some machinery, was completely dislocated, and the soft parts and ligaments so lacerated and torn off and denuded by the blow that the bones appeared to have been dissected clean by the knife. The lower part of the humerus and its condyles projected to near three inches backward so as to be nearly at right angles to the fore-arm, while the heads of the radius and ulna were driven upwards and forwards, and what is singular, without any fracture of the articular extremities, not even of the olecranon. Mr. Prior, finding there were sufficient teguments left sound to cover the wound, that the brachial artery and the nerves of the arm were not injured, and that there was but little hemorrhage, reduced the bones and replaced the soft parts, and thus neatly closed the wound, keeping it in that position by compresses, a roller and a padded splint, with the arm moderately flexed; determining at once *not to amputate*, and to save the arm if possible by what he properly calls *conservative surgery*, too little relied upon, as he thinks, by many practitioners. After many weeks of suffering, during which much inflammation existed in the parts and neighboring muscular tissues, causing several considerable sized abscesses, which were opened, and as well as the wound discharged abundant quantities of pus; and after combating the febrile and local symptoms and pain by bleeding, purgatives, poultices, fomentations and free use of opium internally, the wound, a long time delayed also in its cure by the denudation of the inner condyle, finally healed perfectly, and the limb ultimately was wholly restored in all its

functions. Mr. Prior thinks the *elbow and ankle joints* might in many such apparently terrific lacerations be both, more frequently saved from amputation, and the *knee* also perhaps in many instances, notwithstanding the rather unqualified precept of Sir A. Cooper to the contrary. The free *porraceous vomiting*, noticed on one day in the above case by Mr. Prior, we consider to have been caused by the liberal daily use of opiate drinks. We have noticed this kind of vomiting as a not unfrequent result of large anodynes, especially of morphine.

Mr. Prior has treated several other remarkable instances, where, by his plan of surgical conservatism, fragments or extremities of bones denuded in contusions, fractures, &c., even for a length of time, have been saved by mild treatment and by waiting for nature, as he did in those examples, to shoot out the granulations slowly, but surely, to form the new *periosteum*. Another striking example is that of the left thumb of the engineer of a steamboat, (*London Lancet*, May, 31, 1845, p. 611 à 612,) which had received a violent contusion, and by which the nail and other soft parts on the extremity of the thumb sloughed so completely off as to exhibit, when the dressings which were applied around it for the first days were removed, a perfect denudation of the last or second phalanx from the articulation to its tip. The bone was also perfectly black and offensive. Mr. Prior recommended amputation, but as the patient begged to defer it, the surgeon concluded to try to save the part and did so, using only poultices. In less than half a month the bone had cleansed and granulations began to shoot out beautifully from the sound parts towards the tip till the whole bone was completely covered by the new periosteum, so as to make a good and useful extremity in less than a month—a perfect cure being thus effected without *the necessity of amputation*, or even exsection of any portion of the bone. This is a very different case, however, from that where destruction of the phalanges of the toes and all the metatarso-phalangeal articulating extremities from gangrene, for example, is caused by their having been frozen. Exsection is then imperative, (see our note, Vol. I.)

As another instance of what nature will do in *restitutions of severed parts*, (see this subject fully treated in our Vol. I.) Mr. Prior mentions the case of a boy, (*loc. cit.*) who, in 1815, in the vessel of which he was then surgeon, had about half the middle finger of the left hand near the middle joint so effectually and *neatly* severed by the iron hoop of a cask which fell on it, that nothing but a shred of tegument of the size of a worsted thread was left, yet by soft lint dressing and adhesive plaster around it, aided by splints, a perfect restoration and union was effected.

A case very similar to those above, and which fully corroborates the judicious practice pursued by Mr. Prior, in saving the arm, recently occurred to M. Blandin at the Hôtel-Dieu, Paris, (*Gaz. Méd. de Paris*, Juin 14, 1845, p. 380.) A young man, aged 22, in thrusting his arm through a window, completely tore off the integuments, and the tendon of the triceps down to the condyles of the hu-

mers, with the synovial capsule from the elbow joint as high up as its attachment two fingers' breadth above the olecranon cavity of the humerus, making an ovalar flap which hung down upon the forearm, and completely laid bare the humero-cubital articulation, without however any dislocation or fracture. M. Blandin, after freeing the parts from the clots of blood, and finding there were no bits of glass in the wound, raised the whole flap up to its place and kept it there by six interrupted sutures. The arm was kept in a flexed position. Fever and severe pain and inflammation ensued, producing such tumefaction of the parts, manifestly greatly aggravated, however, by the bridling or traction of the sutures, that these last finally tore out, when immediate relief was obtained. The flap being afterwards maintained in place only by a bandage, the absence of all traction and pressure, led to the rapid cicatrization of the wound and a perfect cure in fifteen days without any further accident, leaving, however, apprehension of ankylosis. These facts prove how correct was the estimate of Mr. Prior in his case of the elbow joint, which was a far more dangerous wound, in taking care to avoid the accidents that occurred to M. Blandin by applying only moderate pressure without sutures; for, as M. Guérin well remarks, (Ib., loc. cit.,) the free dilaceration of the dense, fibrous and aponeurotic and synovial tissues in such large open wounds, into the joints, is itself the reason why such wounds do better than narrow ones; because this dilatation prevents the subsequent strangulation which must ensue when the parts expand under the action of inflammation. The same reasoning, therefore, is correctly applied by M. Guérin in favor of the proscription of sutures in all such wounds. In the case of M. Blandin the arm was probably too much flexed, and kept too permanently in the gutter; otherwise he would not have had to fear ankylosis.

FORMATION OR GROWTH OF BONES.

This subject is germane to *conservative surgery*. Some of the most remarkable and at the same time most satisfactory and practical investigations ever made on the subject of the pathology and physiology of bones, are those by M. Flourens, of Paris, (See his *Recherches sur le Développement des Os*, a memoir read before the Academy of Sciences of Paris at several successive sittings of that body, in 1841, as given in the *Journal des Connaissances Medico-Chirurgicales* de Paris, for that year,) who, uninfluenced apparently by the vaulting ambition to project, as is the *mania* of the day, some entire new superstructure of his own, has modestly and most successfully endeavored to elucidate what appeared to him to be sound philosophical views in such illustrious predecessors as Haller, Traja, &c., in which laborious undertaking, and in the minute repetition, upon a more extended scale, of the experiments on bones of living animals by Traja, he has, as the reward of his unpretending course of conduct, struck out in fact an elaborate and new theory, based it is true on that of Haller, but explaining mysteries and developing laws that were hitherto utterly unknown.

This, it is true, is not the place to enter at length into a dissertation of this kind; but the entire subject is nevertheless connected so closely in every part of it with practical surgery, that some of the general results at least of these investigations should be kept constantly before the mind of the practitioner as well as the student in all operations and reparations upon the great osseous system or scaffolding of the body, for the additional reason also that the laws now demonstrated by M. Flourens in relation to the growth of bones, throw great light as it appears to us on the growth, reparation and reproduction of all other tissues of the body.

In addition to the general system which exists throughout the body for nutrition and absorption, there is a particular arrangement for the changes which are effected in the osseous system. New bone is in fact, he says as Duhamel said, nothing more than the *periosteum ossified*, and this holds true also of the *callus* in fractures which equally has its formative periosteum, which is a prolongation of that of the normal membrane, and secretes also this portion of new bone called the callus.

M. Flourens has ascertained in the most satisfactory manner that in the changes which take place in bones, whether in their normal growth from infancy upwards, or in their reproduction after necrosis, the medullary or internal membrane does the work of *absorption*, while the periosteum *exclusively* performs that of re-formation of new bone. Thus the *entire* radius of a ram was bored, and the medullary membrane destroyed by a probe introduced throughout its whole extent. The death or necrosis of the bone gradually took place. At the same time that the periosteum secreted a new cylindrical layer of bone externally, there was created also a new medullary membrane on the inner surface of this shell; and thus while the new bone continued to be formed externally by the periosteum, the medullary membrane proceeded simultaneously in its legitimate office of absorption. So that when the animal was killed, a portion of the loose sequestrum itself, that is, the old radius in a state of necrosis, was actually found absorbed. This it may be said is the *experimentius crucis* completing those of Traja and Macdonald, re-affirming the theory of Duhamel and furnishing a perfect key to the whole process.

In this master experiment, M. Flourens, in his specimens exhibited to the Academy, proves that the new bone is throughout exactly similar to the ancient; reproducing the form and structure of the latter, down to its minutest details.

In sawing lengthwise the radius of a hog and withdrawing one of the halves, new bone was reproduced between the periosteum and new medullary membrane in various places; and at other points, where the new earthy deposit had not been yet made, the two membranes appeared as if united into one—the medullary, however, being readily divisible into many distinct lamellæ or layers. The internal surface of this new membrane exhibited a remarkable production, viz., on every part of it numerous little projections, (mamelons,) alternating with small depressions, (creusets,) which M.

Flourens looks upon very rationally as the impression made by the work of demolition or absorption on the old bone, as it progressed; in proof of which, another experiment and specimen exhibited corresponding depressions and elevations on the partially absorbed surface of the old bone, which coincided exactly with those of the medullary membrane. Even in a tibia of the rabbit, in which the periosteum had been slit up and detached from the bone by dissection, there was observed, on the external surface and lower end, a small white layer of cartilaginous consistence, already ossified even in some points, and constituting the commencement of the new tibia. But this cartilaginous germ of the new bone was found continuous with the periosteum, which latter had become very thick; and this germ emanated from this periosteum, and was with great difficulty detached from it. Other experiments corroborated this important fact: proving that the bone is formed in the cartilage, the cartilage by the periosteum; ossification, in fact, being nothing more than the transformation of the periosteum into bone.

The new medullary membrane comes also, M. Flourens supposes, from the periosteum. Thus, after a bone is sawed and the medullary membrane destroyed, the periosteum is prolonged, and folds back and inwards over the sawed extremity, so as to pass between the new and the dead bone, (sequestrum,) in order to form, by that means, the medullary membrane. It is, in such cases, an internal duplicature of the periosteum. The experiments establish it. Where the periosteum on a portion of the radius of a ram was entirely destroyed, a new periosteum was reproduced, and this new production was composed, in some places, in part of periosteum and in part of new bone continuous with it.

But what seems a somewhat contradictory experiment, the two halves of the tibia of a duck, in which the periosteum was entirely destroyed, showed that the new bone, and consequently the new periosteum, were entirely formed from the medullary membrane, *and in the interior* of the ancient or dead bone; proving, however, he says, that the medullary is in fact nothing more than an *internal* periosteum, and replaces the *internal*, [*interne* misprint, we think, for *externe*. T.]

If M. Chossat's experiments on pigeons (*Séance de l'Acad. des Sciences de Paris*, Mars 21, 1842; in *Journal des Connaiss.*, &c., de Paris, Mai, 1842, p. 218) be true, we may alter the condition of the bones at pleasure. By feeding pigeons on water and grain perfectly freed of all earthy grit, the bones became exceedingly slender and brittle, and could be easily fractured even during life. It was ascertained, after death, that the osseous portion of the sternum had in some places entirely disappeared, and that it was replaced by periosteum. It is well known that an extra allowance of phosphate of lime is required in the food of birds, &c., to that contained in the food itself. By means also of the *galvanic pile*, he could effect, to a great degree, the entire resorption of the phosphate of lime of bones. This will explain, perhaps, the cures which have been obtained of long-existing contractions of the flexor mus-

cles of the fingers, by electro-galvanic currents, (see our vol. I.;) for, in such cases, the metatarsal bones and phalanges have also, by yielding gradually to the contraction of the tendons, undergone a certain degree of curvature, which we can readily conceive would be overcome by the removal of some portion of their earthy constituents—to say nothing of the softening or *gelatinizing* process effected by such electro-galvanic currents in the indurated and partially cartilaginous, or even earthy, state of the diseased tendons themselves.

It would be well that this subject were more fully examined as to rachitis or mollities ossium, &c., and *per contra*, to ascertain how far (as has been properly suggested) food of a fibrino-plastic and gelatinous quality ought to be employed, (instead of the refrigerants and exhausting, depleting processes of Valsalva,) to aid the formation of the clot in the cure of aneurisms, especially by the mode of compression. Would it not be well, also, to substitute such food in cases of osteo-sarcoma, and in brittleness of the bones generally, as in pregnancy, &c.?

Mr. J. Goodsir, in a recent memoir read before the Medico-Chirurgical Society of Edinburgh, May 1, 1844, (See Cormack's *Month. Journal*, Aug., 1844, p. 729–730,) on the sources of reproduction of bone after the death of the shaft of a long bone, stated that he considered bone as an extra-vascular osseous tissue, accompanied by three membranes, viz., the periosteum, and medullary, and that lining the Haversian canals, to which last he attributes the formation of osseous tissue, also inflammation and ulceration of bone, &c. The process of reproduction after the death of a shaft of long bone, he considered to be as follows: 1st, portions of the old shaft, removed by ulceration previous to its death, and 2d, portions of the membrane of the Haversian canals remaining attached to the periosteum. Mr. Goodsir does not believe that any new bone is formed from the periosteum, properly so called, or from the epiphyses, as has been supposed by some pathologists.

Dr. Lawrie, of Glasgow, agreed that bone could only be produced by bone. In flat bones, and in those of the skull, he remarked that bone is very slowly, if at all, reproduced; but sooner on the base than on the vault of the skull; and that the deposit is greatest on the inner surface of the bone. In injuries of the bones of the face, reproduction rarely if ever takes place; but in the lower jaw this process is more rapid, perhaps, than in any other bone of the body; owing, as he conceived, contrary to the opinion of Mr. Goodsir, to the *presence of epiphyses* and a large proportion of vascular, cancellated structure in the lower jaw and long bones, both of which were absent in the bones of the skull and face. There is no record of the reproduction, after death, of an entire bone. In necrosis of long bones, he had remarked a similar groove or line of separation between the dead and living bone as in soft parts, and then the deposit of living bone close to this line, which process continued above and below until the new deposits met and ultimately surrounded the dead portion of bone; the periosteum playing no

other part than that of a mould, on and within which the new bone may be formed. The dead portion, he said, instead of aiding, interfered with the process.

The great point of interest, however, is the *surgical treatment*; which consists in removing the dead portion as early as possible after the line of separation is completed. The outer case (encasement) of the shaft, he remarked, almost always dies to a greater extent, both in surface and depth, than the cancellated internal structure; and the dead portion being thus held in its place by the living parts within it, is mechanically prevented from escaping in the early stage of the disease, and still more so in the latter stages, by being surrounded by new bone. To prevent its being thus enclosed, the dead portion should be exposed, and cut across, as near its centre as may be, with the bone forceps (*i. e.*, Liston's cutting pliers or scissors) or chain-saw, and the fragment loosened and removed; by which mode he had seen more than one limb, at Glasgow, saved from amputation. When an entire portion of bone dies, which is rare, it easily makes its way out by ulceration, requiring only the dressing forceps to detach it. This mode of treatment is peculiarly applicable to the leg and fore-arm, from their having two bones each. But there are cases in which it may be had recourse to in the femur and humerus, and in which amputation may thus be avoided and those portions of limb saved, as he had seen in one case of the humerus.

Mortality from amputations also furnishes new arguments for conservative surgery. Dr. Bullen (*London Lancet*, Sept., 1844) gives this favorable result of 58 amputations at the Northern Hospital of Cork: *above the knee* 19, of which 13 were by the circular operation and 5 of these fatal—5 by the flap operation and 1 death; *under the knee* 29, viz., 26 circular and 2 deaths, 3 flap and 1 death; *at the arm* 12—3 circular and 9 flap—all recovered; at the *fore-arm* 6—5 circular, 1 flap—all recovered; at the *shoulder* 1, flap, recovered. Dr. Bullen says, the greater success of amputations in the British islands than in France, is owing to a certain sang froid of constitution established by their religious faith, and preponderance of vegetable food. As respects the latter we think him in error, for few people live more exclusively on vegetable food than the French, as far as our observation extends in travelling more than once through most of the provinces in that country. Leguminous food, lettuce, oil, grapes, chestnuts and bread from the cerealia, with olive oil, constitute the great bulk of sustenance for the mass of the population, at least in the middle and southern provinces. In Ireland probably more milk and potatoes are consumed by the mass than in any other country, and what richer animal and nutritive food can there be than this, as is evident from the robust health which, notwithstanding the alleged starvation, (in some districts,) and the damp atmosphere, (but one of great healthiness, however, from its equable temperature,) and the uncomfortable cabins of the poor, is so strikingly characteristic of this people. The same is true of the mass in England

and Scotland. If there is any difference in the general health of the population of the British islands and that of France, it is in fact as we think in favor of the latter, for they go more in the open air, take more exercise on foot and in their healthy sports, than either the English or Irish do, and besides have fewer confined in the unwholesome air of manufactories, and are constitutionally of a more mercurial and recuperative temperament than is found in the Anglo-Saxon race.

In regard to the prognosis in amputations, Dr. Bullen considers that reunion is contra-indicated when the patient is advanced, and the lower extremities have been a long time the seat of chronic inflammations. In such, he remarks, the veins are sometimes found exceedingly varicose, and in correspondence with this condition the calibre of the arteries very small. Hence the abundance of hemorrhage after the operation in such persons, and the difficulty of restraining it. The tourniquet by producing a venous congestion in the limb augments the bleeding, and even the pressure of the bandaging alone will often of itself renew the bleeding many hours after the operation. The muscles in such patients are of a purplish red color, soft, and possessing little retractility; while the integuments are flabby and of a livid color. There is clearly a local atony and deficiency of vital action, to remedy which the proper means are to be employed to place the parts in a condition to favor reunion. The hemorrhage is to be arrested by removing the tourniquet and every kind of compression; the leg to be placed in a flexed position upon the thigh, so that the stump may be elevated, while in the meantime a stream of cold water is to be made to fall on its surface from a certain height. Lotions impregnated with alum and exposure to a current of fresh air will now soon arrest the venous exudation which may continue to run from the wound. Immediate reunion must not be attempted in such cases; for if it takes place, the compression caused by the required dressings may of itself induce gangrene of the stump, which in such aged enfeebled subjects is always fatal. To prevent this the proper local and general stimulants are opium, sub-carbonate of ammonia, wine and nutritive diet internally; and an ointment of elemi and turpentine to the wound to promote healthy granulations.

Mr. Inman (*Lond. Lancet*, Oct. 5, 1844, p. 39) gives a *table of amputations* collected for many years from amputations in Europe and America, in hospitals, in the field of battle, on ship board, in vessels of war, &c., by which it appears, without attempting to deduce any conclusions very positive from such scattered and heterogeneous details as to time, place, nature of amputation, &c., that out of 3586 examples of these operations 1146 perished, or 1 in every $3\frac{1}{6}$. T.]

SECTION X.

OF THE EXSECTION (Résection) OR EXCISION OF BONES.

THE operation of exsecting bones, though already performed at the time of Galen for certain bones of the trunk, and, as would appear, for some of the articular extremities, was never actually introduced into practice after fixed rules until about half a century since. It is performed in the continuity as well as at the extremities of the bones, and almost always with the view of preventing the amputation of the limb.

PART FIRST.

EXSECTION IN THE CONTINUITY OF BONES.

In the continuity of bones exsection may be required, either for recent compound fractures, ancient ununited fractures, caries, necrosis, osteo-sarcoma, spina ventosa, or any other incurable organic disease.

CHAPTER I.

ON EXTRA-ARTICULAR (Hors des Articulations) EXSECTIONS IN GENERAL

When it is proposed to perform excision or exsection on the continuity of the bones, we require a particular kind of instruments. Those most frequently in use among surgeons are : the cutting nippers, [or pincers,] (*tenailles incisives*,) cutting pliers, (*cisailles* or shears,) saws of different kinds, the trephine, gouge and mallet.

ARTICLE I.

The ordinary cutting nippers [or pincers] (plate 3) answers sufficiently well for those points or plates of bone that project, or which may readily be brought to the surface. Its size and form prevent our using it in the depth of wounds. Among the cutting pliers are

those of M. Zeiss, (*Gaz. Méd. de Paris*, 1838, p. 375.) They are scissors with short, narrow strong blades, armed with fine teeth and long branches. As they may be introduced into narrow openings, and even into the depths of wounds, they enable us to cut while they at the same time saw through (*de couper en sciant*) splinters, fragments, and in fact the entire thickness of bones of a certain volume, and thus allow us in a multitude of cases to dispense with the employment of the saw.

ARTICLE II.

M. Liston has substituted for the ordinary cutting nippers, an instrument still more simple and not less valuable, (plate 4.) The *cutting pliers* (*ciseaux*) of M. Liston differ from the cutting pliers which I have mentioned only in this, that their blades besides being shorter and narrower are provided with a perfect cutting edge. The blades of M. Liston's pliers, which are flat on one side and shaped into a deep bevel on the other, cut wonderfully well the phalanges, and the bones of the metatarsus and metacarpus, and could be used to make the section also of the ribs and all boney fragments which do not exceed these last in size, also in exsections at the bottom of fractures whether recent or ancient.

ARTICLE III.

Other *osteotomes* more powerful, and constructed after the same idea, have been devised by M. Colombat and M. Manec. Having occasion to perform exsection on the ribs in 1835, I arranged an osteotome in such manner that its lower blade (*lame profonde*) bent in the form of a hook, allowed the cutting blade to come down with all its power upon the rib without causing it to slip. The cock's comb (*en crête de coq*) and the watchmaker's saw, the different kinds of hand-saws and amputation saws, are too well known to make it necessary to describe them here.

But saws which allow of our operating with them in the depth of the tissues, and which have been specially invented for the exsection or excision of bones, require in this place that we should give a short description of them.

ARTICLE IV.

The *articulated or chain-saw* invented and described by Aitken, (*Principles of Midwifery*, London, 1784,) (vid. plate 3,) erroneously attributed to Jeffray, (*Excision of Carious Joints*, etc., 1806,) who himself acknowledges that he borrowed it from Aitken, is not less valuable for exsections than for amputations. Another saw which allows of our exsecting bones wherever they may be situated, and in every possible way that can be conceived, and which acts on bones as the bistoury does on flesh, is that of M. Heine, (plate 6,) composed of the chain-saw of Jeffray, mounted on a series of wheels,

and which is moved by means of a crank, (*manivelle*,) at the same time that the hooks (*crochets* or *hasps*) and shaft admit of our fixing it or inclining it in any way we wish. This saw, which, according to the author, (*Gaz. Méd. de Paris*, 1834, p. 644,) had in 1834 already been put to the proof on living man on fifty occasions, has no other disadvantage but that of being very complicated and of requiring a certain degree of practice in order to be properly handled. The modification, however, which has been made of it at Paris by the manufacturers Charrière and Sanson, has rendered it sufficiently simple for all surgeons to procure and make use of it.

Toothed rowels, (*molettes à dents*,) mounted upon a shaft analogous to that of Heine, were thus susceptible of being transformed into *vertical saws* of different diameters, under the names of Thompson's saw, M. Leguillou's saw, &c. But a saw which surpasses these, in its advantages, is that which is called Martin's, (Pl. 7.) This is constructed with a shaft, having some resemblance to that of a trephine, whose crown should be replaced by a disc either flat, (plane,) or convex, in form of a mushroom, and the circumference of which would represent a saw. With this instrument we may exsect bones transversely, obliquely or vertically, without the necessity of their protruding beyond the skin. We may even excavate or hollow them out, as artists groove out wood, provided we make use of the convex disc in place of the flat one. A glance at the figure I have given of it, will explain its mechanism and construction better than a long description. The small saws of M. H. Larrey, and of M. Rambaud, (Pl. 7,) also deserve consideration.

As to the gouge, mallet, and different portions of the trephine, and the rotatory (*tournante*) saw of M. Thall, (*Arch. Gén. de Méd.*, t. I., p. 268,) I have nothing particular to say, or shall speak of them under the head of *Operations with the Trephine*. The same may be said of rasps, (*rugines*.) levers and elevators, which we may also have occasion for.

ARTICLE V.

The *articles for dressing*, (*pièces d'appareil*,) with which we should be provided, are generally sufficiently numerous. Besides those which are demanded for every serious (*sanglante*) operation, the exsection of the bones of the limbs especially, almost constantly requires also those which are employed for fractures. We must, therefore, have in advance, either splints and bands, or pieces of pasteboard and the bandage of Scultetus, or long bands, and also some of the preparations for making immovable bandages, (For all which, see Vol. I., *passim*.)

ARTICLE VI.

During the operation, also, it is frequently important to put ourselves on our guard against hemorrhages, and to have recourse to provisional hemostatic means, as in cases of amputation. Forced

to act upon organs whose mobility is increased, and where every movement sometimes occasions violent pain, the surgeon has need also of intelligent assistants, and a sufficient number of them.

CHAPTER II.

EXTRA-ARTICULAR EXSECTIONS IN PARTICULAR.

As to the consequences of the operation, considered under a point of view purely pathological, they are the same as those for compound fractures or amputations.

ARTICLE I.—COMPOUND FRACTURES.

When in a fracture the extremity of one of the fragments escapes and makes a projection through the lacerated integuments, if the proper dilatations (débridements) and prudently directed efforts are not sufficient to replace the parts, the exsection of the bone which protrudes beyond the wound has always been recommended and practised. The operation, under such circumstances, is one of the most simple. Two assistants grasp the limb, one the upper, and the other the lower portion, in order to increase its curvature, and make the bony points protrude out more from the wound. The operator enlarges the wound, if it should appear necessary, protects the tissues by means of a piece of linen or paste-board, and makes the section of the denuded bone, either with an ordinary saw, or with any other instrument whatever, suitable to the form and position of the part. The same means are to be recurred to, in a multitude of other cases. If the fragments are sharp and prick the flesh, or if they escape from the wound on the least movement, or are cracked or denuded to such degree as to render necrosis inevitable, their excision would prevent many accidents, and evidently facilitate the consolidation. It is to the tibia and fibula, and to the bones of the fore-arm, and some of the phalanges, that we are most frequently obliged to apply this species of exsection.

[*Stethoscopic Diagnosis of Fractures.*—Our author does not treat of fractures in any part of his work, except as incidentally connected with exsections. The following, however, though inapplicable to exsections of protruded fractured fragments, is worthy of insertion, as indicating the progress of one of the *hobbies* of the day:—

Mr. Grantham (*Facts and Observations on Medicine and Surgery*, London, 1845, p. 61) says the stethoscope has, at least, one great advantage, that a mere slight pressure of the ear upon it, will often communicate the sound of the *crepitus*, and thus render it unnecessary to recur to painful manual examinations. In the solid

bones the crepitus is more sonorous, and like breaking a piece of wood over the knee; in the spongy bones it is duller and like a rasp on wood; in oblique fractures it is stronger than in transverse; but where one bone rides over another, he admits it is obscured, and then we may have to use extension and counter extension to procure it; when fluids are effused around the fracture, we have, besides the crepitus a gurgling sound, compared, Lisfranc says, to a shoe-full of water. In inflammation of the cellular tissue, when the serum becomes suppressed and the cells filled with air, these parts will convey a dry crepitus rattle, often mistaken for the fracture, and especially for a fracture of the fibula. This is most distinct on the third day, and decreases on the fifth. We have a sound like this in common sub-cutaneous emphysema. T.]

After wounds from fire-arms, when the bone, or principal bones of a limb have been shattered or reduced to splinters, and the soft parts are not too extensively laid open, (*délabrées*,) instead of proceeding to amputation, it has been prudently suggested, that we should first extract the detached, boney fragments, and afterwards cause to protrude out of the wound the angular fragments of the two ends of the broken bone, in order to isolate and exsect them. In such cases, the surgeon is almost always obliged to enlarge the primitive wounds, or even to make new ones. He makes his incision usually in the direction of the axis of the limb, at a point which is the farthest distant from the vessels and nerves. By this wound, we cause the protrusion successively of the two ends of the fracture. After having properly isolated them, we exsect the points and all other parts that might interfere with the cure, proceeding in other respects as has been described above.

From the sententiousness of certain passages in Hippocrates, relative to exsection of bones, it would be easy to maintain, that in his time they exsected every thing that was denuded in certain cases of fracture. This is the doctrine of Celsus, Galen, Guy de Chauliac, Tagault, Paré, the two Fabricii, (*Jérôme Fabrice*, *Opér. Chir.*, pars 1, lib. 4, cap. 10, et Trad. Franç., p. 451,) Gournelin, and Dalechamps. Up to the close of the last century, however, we find scarcely any others than Paul of Ægina, (*Paul d'Egine dans Dalechamps*, *Chir. Franç.*, ch. 107,) and Séverin, (*Séverin dans Bonet*, t. I., p. 316,) who have given extension to the operation of exsection, by recommending it upon a more or less considerable portion of the whole calibre of the body of the bones. In the defect of general precepts on this subject we are indebted to the custom of publishing particular cases, for the knowledge we have of some instances of fracture, where exsection has been extensively performed by skilful and enterprising men, who have taken counsel only from their inspiration, and whose boldness has been crowned with complete success.

The first systematic work in which the recommendation of exsection has been generalized is that of Pott, translated and commented upon by Lassus, who refers back to the precepts of Paul of Ægina, and explains, in a very precise manner, the excision of

bones. But Hévin abandoned exsection to simple relaxation of the muscles, though Bourbier (*De Necessitate et Utilitate, etc.*, 1776) had supported at Strasbourg a very remarkable dissertation in its favor. *When the bone passes out (passe) death ordinarily ensues*, says Courtin, (*Leçons Anat. et Chir.*, p. 696, A. D. 1612,) while speaking of fractures of the humerus.

Bourbier sustaining his positions on the authority of the ancients and of Rossius, Diemerbroeck, Scultetus, Roneb, Siebold, Munnicks, and Gaignière, thus expresses himself in his thesis: "Since it is certain," says he, "that the fragments of the displaced bones wound and irritate the neighboring parts, let us seek in the nature of the disease itself the treatment to oppose to it. We ought to remove *by means of the saw a portion of the projecting bone sufficient to effect the reduction immediately*, and without any concussions or tractions. Then the pain will cease, and to the state of agitation which the patient is in will succeed repose and tranquillity. The apprehension that we shall have accidents supervene, or that those which already exist will be aggravated, will be alike dissipated." It is a very difficult point here to pronounce on the cases where we should procrastinate or recur to what Severin calls efficacious surgery.

1. Without excision would there be exfoliation of the fragments detached from the body of the bones, but which are still adherent to the soft parts? I have seen splinters of bone that did not reunite, yet retained their vitality in the midst of the tissues. I have seen such in the thickness of the muscles of the fore-arm, and once in the lower part of the arm, in the dead body, in subjects in which the fracture had been consolidated for more than fifteen years.

2. What is the action of such fragments on the secretion of the callus even when they must pass into necrosis, or when they are extracted, what is their effect on the shortening of the limb?

3. If they are of great importance and ought to be removed, how are we to distinguish the cases where their presence would give rise to accidents which would endanger life, or where their extraction would have been more advantageous than their incarceration within the osseous callus?

4. What is the influence of the continuity of one of the two bones (the smallest especially) on the preservation of the length and straightness of the limb and the reproduction of the parts destroyed?

If we remove all the splinters and cut off the ends in the body of the bones, we may possibly indulge the hope of effecting a consolidation of the fracture, at least for the femur, humerus and tibia; but what are the signs which will enable us to distinguish those cases where an operation might result in a pseudarthrosis? Nor is anything more known of what takes place in relation to the shortening which occurs under these last mentioned circumstances. We find facts for and against the propositions which I have just enumerated. M. A. Cooper has found, in excising a portion of the radius or some other bones in rabbits that a void was left behind,

and that no osseous reproduction was effected in the place of the piece removed. Others have seen the reverse of this, and facts in practice authorize us to sustain both the affirmative and negative of this position. The course, also, which surgeons take under these circumstances is far from being uniform. Some confine themselves to extracting the detached splinters and fragments, while they replace the adherent pieces with the hope that they may become united or that nature will expel them. The presence of such splinters in the wound at least lessens, it is asserted, the shortening of the limb, by keeping the ends of the fracture apart, and by serving as a sort of mould or nucleus (filon) for the reparative calus. G. Fabricius (Bonet, t. II., p. 185 and 198,) was a zealous partizan of this practice. Others, on the contrary, dilate largely, extract all the detached fragments, empty the cavity (foyer) and cut off, when necessary, the ends of the fractured bones, in order to reduce the wound to a simple state, and in the hope that they may thus prevent inflammations, consecutive abscesses, delay in the formation of the callus and necrosis; also the retention of the sequestra and the interminable fistulæ which they are so often the cause of, together with those tedious operations which are sometimes necessary for the extraction of the splinters. Le Dran and Bagieu, and especially Bilguer, together with Schmucker (Sprengel, t. VII., p. 326—327,) and Thédén, are great advocates of this method, which I have also frequently employed with marked advantages.

§ I.—*Bones of the Hand.*

The importance of the smallest osseous piece to the hand, makes it necessary that we should never sacrifice it, except it be impossible to preserve it. So also it is better, in cases of fractures with crushing of the phalanges or bones of the metacarpus or wrist, to remove the splinters, and to exsect or excise the projecting points, and make the proper dilatations, than to amputate the parts injured. The forceps, cutting pliers, scissors of Liston, rowel saw, that of the cock's crest or the watchmaker's will suffice in such cases. I have in this manner had it in my power, in removing portions of the phalanges, metacarpus or carpus, to save in a great number of patients a thumb, a fore, middle, or even the little finger itself. The operation, in other respects very easy, varies necessarily according to each particular case, and cannot be described.

§ II.—*Bones of the Fore-arm.*

The memoirs of the Academy of Surgery contain two remarkable facts (t. II., in 4to, p. 529; t. VI., in 12mo, p. 141) relative to the extraction of splinters from the two bones of the fore-arm. We find, also, that Bilguer removed a portion of the ulna which had the length of four fingers' breadth. La Franboisière (Bonet, t. IV., p. 237) speaks of a loss of substance in the ulna of the length of

four fingers' breadth, caused by the extraction of splinters, which filled up with flesh, and became so indurated as to take the place of the portion of bone removed, without making any curvature in the fore-arm at this place. The extraction of a very considerable portion of the ulna, without causing any change in the form of the arm, was effected at that time also by Dupuytren, (Champion, *Thèse* No. 11., Paris, 1815.) Here is a fact not less remarkable: a fracture of the body of the radius by a fire-arm, (a fusil charged with twenty large slugs, and the barrel against the fore-arm;) the charge remains in the limb; on its palmar side contused flesh, numerous splinters and fragments on a level with the surface, (en flûte,) and denuded. The ulna was laid bare above the fracture. A long incision was made on the radius, in front and behind; the fragments dissected on a line with the denudation, and exsected (by means of a cultelaire saw passed into the two wounds) to the extent of an inch and a half below, and two inches above. Extraction of the splinters and fourteen balls.

The contused tendons of the two radial muscles necrosed, and some abscesses supervened in consequence of the slugs scattered throughout the tissues; the wound healed in six months. The three last fingers preserved their movements. The wrist ankylosed. The patient, who was strong and robust, resumed his occupation of mason. There remained between the extremities, in the continuity of the radius, an interval of five inches, which was occupied only by soft parts. The limb, which preserved its straightness, though there was no reparation of substance, recovered as much strength as the other. M. Champion was assisted in this operation by M. Collignon and M. Pellier of Nancy, who was then there.

Three men, says M. A. Séverin, (Bonet, t. I., p. 316, chap. 10,) vainly endeavored to reduce a fracture complicated with protrusion of the radius externally. The bone-setter, Marc Blaise, could not effect his object. The ends of the bones were exsected with a saw, and the patient recovered. Perhaps the difficulty here arose from the tractions not being made in the proper direction. Deschamps (*Ancien Journ. de Med.*, t. LXIX., p. 471) relates that it was determined to amputate the fore-arm in a case where the lower fragment of the radius protruded from the wound, and formed there a draw-bridge, (pont-levis;) the parts had been placed in pronation; when he caused them to be placed back in demi-supination, the bone suddenly entered (into its place.) M. Saint-Hilaire (*Considérations sur les Os de l'Avant-bras, etc.*, p. 10, 1814) speaks of a patient in whom it became necessary to exsect the two bones of the fore-arm which had been fractured at their epiphyses, and protruded through the soft parts.

Operative Process.—When the removal or excision of splinters and fragments becomes necessary in fractures of the fore-arm, the operation must necessarily vary according as the bones protrude through the skin, or are simply broken at the bottom of the wound. We may enlarge, without any fear, the wound of the integuments.

We then give a greater curvature to the limb, and surround and protect the root of the fragment with linen, pieces of pasteboard, wood or metal, afterwards exsect them with the saw where the whole thickness of the osseous cylinder is to be divided, or with the cutting nippers or pliers, when some points of bone only are to be removed. As a general rule, it cannot but be advantageous to remove a large portion of the bone, and there would be an inconvenience if we did not give ourselves plenty of room in excising it. The radial and ulnar arteries, with their accompanying nerves of the same name, and the median nerve, are the only organs which it is important to avoid. As they are situated in front, and nearer to the axis of the limb than the bones are, the ulna or radius ought, by preference, to be inclined towards the posterior or outside of this axis when we wish to exsect them.

All the points of bone being thus destroyed, we cleanse the wound of the foreign matters it may contain, and proceed immediately to the reduction by making the proper tractions and extension.

If the bones do not protrude externally, when it becomes necessary to remove any portion of them, we begin, unless the tissues are extensively lacerated, by enlarging the principal wounds of the skin as much as possible in the direction of the axis of the limb. By means of a strong forceps, we remove from the wound the splinters and fragments which it may be thought advisable to sacrifice; and then proceed to the excision or exsection of the extremity of the two ends of the fractured bone, if they should be so sharp as to irritate the soft parts, or seem calculated to produce any mischief, (accidents.) During all these manipulations, the fore-arm should be held in a state of flexion, and in such manner that all its muscles may be as much relaxed as possible. The assistant and surgeon, it will be understood, are to give to the fore-arm all those inclinations and inflexions which will enable it to check the tension and tractions caused by the fracture.

§ III.—*Bones of the Arm.*

The exsection of a portion of the body of the humerus, in cases of fractures, is one of those which we most frequently have occasion to perform. Science possesses a very great number of examples of this kind. Nevertheless, the formation of a pseudarthrosis was the result of this operation in a patient of Theden, and in the case of Lelong, as mentioned by M. S. Cooper, (Bourbier, *Op. cit.*, § 8.) Most frequently, however, the operation has been followed by complete success.

An infant eight years of age, says Diébold, (*Dict. de Chir.*, t. I., p. 479,) a distinguished surgeon of Strasbourg, fell from a horse and fractured the humerus a little above the epiphysis; the biceps was torn, the bone protruded about two inches, and reduction could not be effected. Twelve days passed on, and gangrene had already attacked the muscles of the arm. Diébold being sent for to perform

the amputation, confined himself to exsecting about six lines of the protruded portion of bone, when he easily effected a reduction. It then became necessary to arrest the progress of the gangrene, and to favor the exfoliation of the tendons and of the ligaments in the neighborhood of the articulation, when, after the expiration of six weeks, a healthy cicatrix replaced one of the most frightful looking wounds.

In the case of a *fracture of the surgical neck of the humerus*, noticed by Sylvestre, (*Ancien Journ. Méd.*, t. XXXIX., p. 275, 1773,) one of the ends of the bone protruded an inch and the other half an inch, and they had been in this situation *from seventeen to eighteen days*, during which time frequent attempts had been made at reduction. Three of the surgeons proposed amputation: the wounded man was exhausted. Sylvestre being called in, made, at different times, incisions and counter-openings, and applied pungent (âcres) substances to the ends of the fractured bone; exfoliation of the upper end of the bone took place; the change made in the inferior end *not having yet enabled it to detach itself immediately*, Sylvestre removed its carious portion with the saw, effected the reduction, then kept the bones in coaptation (affrontés) by four immovable (inamovibles) splints, made frequent dressings, healed up the *thirteen* openings in twenty-seven days, and consolidated the fracture in two months. Bourbier speaks of a fracture of the humerus, situated immediately above the condyles, in a boy aged eight years; the upper fragment protruded through the skin on the inner side of the biceps, while the lower was drawn backwards; Nochet, of Laon, could not reduce it, notwithstanding a dilatation which he made of two inches extent, and repeated efforts of extension. On the following day there was a violent pain, with fever and subsultus of the tendons, and the life of the patient in danger. Five physicians and surgeons united decide upon amputation. Bourbier, who arrived on the third day, proposed exsection, which was performed by Gaignière. An inch of the bone was removed, when the remainder was replaced with the greatest ease. All the symptoms subsided, and the most perfect success crowned this operation. In three weeks a firm cicatrix filled up the wound, and the callosus was already sufficiently solid to allow of the patient returning to his relations. M. Belair, (*Journ. de Med.-Chir. et Pharm. Milit.*, p. 233, Mai, 1815, No. 2,) on the twentieth day of the accident, excised from 5 to 6 lines of the upper fragment of the humerus fractured near the shoulder, because this fragment, being denuded, pierced through the skin in spite of the dressing. The patient recovered.

In a case of fracture of the humerus above the condyles, noticed by M. Vial, (*Recueil de Méd. et de Chir. Milit.*, t. IX., p. 271, 1821,) in a child of five years of age, the upper fragment protruded through the flesh to the distance of fourteen or fifteen lines. With these there was also laceration of the brachialis internus muscle, of the inner border of the biceps, of the branches of the internal collateral artery, a copious hemorrhage, and a shortening of the limb of nearly two inches. Compression of the artery, efforts at reduction,

extension, graduated compression upon the fragments—in fact, nothing succeeded. The tumefaction and contraction of the muscles strangled the fragment with such force, that it was impossible to introduce a probe between the parts. After having glided under the bone a retractor of wood, cut in a crescent form, (*en croissant*), a portion of it 14 lines long was excised. The wound healed up in fifteen days, and the fracture consolidated in thirty-three. The movements of the arm were re-established on the *sixtieth* day, without any shortening of the limb! A comminuted fracture of the lower extremity of the humerus, with protrusion of the fragments and separation of the condyles, made it necessary to excise the *upper* fragment during the first days. A protrusion of a part of the lower fragment took place at a later period. A rigid diet, and bleedings renewed as often as necessary, arrested the hemorrhages, which had occasioned much uneasiness. The patient, who has resumed his occupations, says M. Charpentier, (*Société des Sciences Méd.*, de Metz, p. 21, 1822,) experiences only some difficulties in the movements of extension of the fore-arm.

A child, aged seven years, fell from a horse on the 15th of May, 1819, and fractured his left arm. M. Heriot, who arrived from Pont-à-Mousson two hours after the accident, found the humerus fractured across its lower portion, and so near the articulation, that the upper fragment included a part of the olecranon fossa of this bone. This fragment, which had torn and penetrated through the tissues and skin upon the fore-part of the arm on the inner side of the biceps, made a protrusion of an inch in the bend of the arm. The brachial artery and the median nerve were found denuded and stretched across the extremity of the bone like the cords of the violin over its bridge. After having satisfactorily ascertained that the tuberosities of the humerus were not fractured, and that the portion of the bone to which they belong was entire, notwithstanding its shortness, M. Heriot proceeded to enlarge the wound up and down, and slit open its borders transversely in the bend of the arm; this did not prove sufficient; the reduction could not be effected. The angles of the humerus were now cut off with a strong pair of scissors, with the hope of liberating the artery and nerve; but these last-named organs were too tensely stretched to yield. The surgeon then made up his mind to tie the artery and divide it, as also the nerve, and to excise with the saw, to the extent of an inch, the portion of bone which protruded beyond the wound.

After this operation, the reduction was easy; the patient was placed in bed, with the arm in a position of semi-flexion, and the elbow slightly elevated upon a cushion of oat chaff. The borders of the wound were brought together and dressed with dry lint, after which the limb was covered with an emollient poultice. The ligature came away on the eighth day, and the ends of the bone were united (*en contact*) on the twenty-first day. The action of the muscles had dragged the lower fragment forwards, and it was found necessary to let it consolidate in this position. The inflammatory

tumefaction continued to the thirtieth day from the accident. The patient could at that time raise his whole arm at once in one movement (*par un mouvement de totalité.*) At this period the fore-arm was placed in a gutter of pasteboard, supported by a scarf, in order to allow the child to walk about. Two months and a half after the fracture, extension could be performed almost perfectly, and appeared to be in no way incommoded, except by the cicatrix of the wound. Flexion could be performed to two-thirds its extent, and movements of pronation and supination could be executed the same as in its healthy state. The sensibility of the limb was not impaired, and M. Heriot noticed no other result from the section of the median nerve, except a temporary pain in the fingers, especially in the middle finger, of which in fact the patient complained at the time of the operation.

M. Champion, who communicated to me the particulars of this important case, guarantees its authenticity.

The following case, for which I am also indebted to M. Champion, shows what should be done for the other extremity of the humerus.

Oblique Fracture of the Surgical Neck of the Humerus.—The lower fragment drawn upwards and in front of the scapulo-humeral articulation, raised up (*soulevé*) the soft parts above the acromion. Attempts at reduction proved useless though the girl was young (aged seventeen) and of a lymphatic temperament. The inability to effect the reduction could only be imputed to the impossibility of disengaging by the efforts at extension, the lower fragment of the humerus, which was imprisoned in the fibres of the deep-seated layers of the deltoid which it had penetrated. An incision was made into a sero-sanguineous extravasation on this fragment, and the lower extremity of the fractured bone denuded to the extent of eighteen lines. This portion was now exsected, and the cure of the patient effected. A great part of the motions of the limb were restored with scarcely any perceptible diminution of its length.

Operative Process.—The humerus which so often places the surgeon under the necessity of performing exsection upon it when fractured, exacts during the operation precautions which it is scarcely possible to systematize under any fixed rules. Both at its middle portion and its extremities it would always be most prudent to begin with the fragment which projects backwards and outwards. For in these directions the dilatation of the wound and the incisions which we are under the necessity of making, compromise only the integuments or muscles. In front, on the contrary, and especially on the inner side, we should have to be on our guard against the wounding of nerves and vessels of considerable size. Perhaps it would be practicable, after having thus given ourselves sufficient room, to incline the other fragment also in the same direction, in order that we might exsect that also without incurring any additional risk. Nevertheless if the tissues should be lacerated upon the inner side and in front, the operation should be performed in

that direction. We must then accurately recal to mind the relations which the brachial (humérale) artery, median nerve, ulnar nerve, and even the radial nerve, have with the ends of the fracture. And it would not be until after having separated or pushed them to one side or the other by incisions and tractions skilfully managed, that we should undertake to apply the saw or cutting pliers upon the bones, taking care moreover when doing so to give them during the operation a strong inclination, and to make them project as much as possible beyond the integuments.

Whether it be the fore-arm or the arm, it is important after the exsection of the bones and the removal of the splinters has been completed, that the limb, if it has been fractured through its whole thickness, should be fixed in an apparatus which shall keep it immovable, while at the same time it admits of the daily dressing of the wounds. The starch bandage (bandage inamovible) which perfectly fulfils this indication, is here of great advantage. We should therefore now surround the whole of the fore-arm and arm, from the roots of the fingers to the shoulder, adding at the same time some turns of spica, with a roller bandage interlaid (*entremêlé*) with some pieces of pasteboard and saturated with dextrine, taking care to leave openings (*fenêtres*) at every place opposite to the wounds, so that at the time the desiccation of the dressing is completed, the whole limb may be maintained in the position which we desire it to have up to the termination of the cure. [See note Vol. I. on the starch bandages and their extreme danger when not applied with the precaution pointed out by the author. See also the case of Mr. Dubowitsky, same volume. T.]

If, however, the fracture should not go through the whole thickness of the bone, or if, as I saw in 1830, in the case of a man whose arm had been traversed by a ball, the half or two-thirds only of the calibre of the humerus had been fractured, then after having completed the extraction of the fragments of bone, this bandage would no longer be indispensable, and the wound should be treated like any other wound from fire-arms.

§ IV.—*Bones of the Shoulder.*

It is seldom we are called upon to perform exsection upon the bones of the shoulder in cases of their fracture; it should be fearlessly made, however, where the bones are laid bare and present pointed fragments at the bottom of the wound. I should not hesitate, for example, in a case, to excise the ordinarily too acutely pointed extremities of the fragments of a fractured clavicle, if they had lacerated (*dilacéré*) the integuments. One of the wounded of July, 1830, who was wounded by a discharge of fire-arms upon the front part of his shoulder, received thereby a fracture of the clavicle, coracoid process and head of the humerus, all at the same time. After having extracted from different recesses of the wound a variety of projectiles and a great number of splinters, I removed by means of the cutting pliers and the cock's comb

saw, the projecting points of three bones mentioned, and the patient ultimately got well.

The acromion, notwithstanding it seems by its relations to be indispensable to the functions of the arm, should nevertheless be freely exsected, in cases where it is fractured and protrudes through the skin. After the cicatrization of the wound, the clavicle supported by the coracoid process would take its place completely. As a proof of this assertion I mention the case of a patient who had the whole acromion extracted out entire for necrosis without experiencing any perceptible diminution in the strength or motions of his arm, and the case of another man who with an ununited fracture of the acromion felt no sort of inconvenience whatever from it.

It is unnecessary to add that in fractures of the body of the scapula, the osseous angles, are not to be spared but are to be exsected largely.

§ V.—*Bones of the Foot.*

The bones of the foot, in cases of fracture, rarely require exsection, except there is also luxation at the same time. In treating therefore of the exsection of the extremities of bones, I shall be permitted to recur for a moment to what relates to them. There are none others but those of the metatarsus which can in reality require any attention in this respect on the part of the surgeon; nor do they then require anything like the precautions which become necessary for the bones of the hand. Thus if a fracture should take place in any one of the bones of the metatarsus, it would generally be better for the maintenance of the functions of the foot to amputate this bone with the corresponding toe, than to exsect the two fragments. We should decide upon this last operation only in the case of a fracture of the first metatarsal bone, or where the digital extremity of each one of the other metatarsal bones had been left unimplicated. The exsection in such cases also should be made with Liston's pliers, the rowel or the cock's comb saw, or with the cutting forceps.

§ VI.—*Bones of the Leg.*

In cases of compound fractures of the leg, we may have to exsect the fibula or the tibia, or sometimes both bones in the same patient.

A. *Exsection of the Fibula.*—Scultetus, (*Arsenal de Chir.*, trad. Franç., p. 104, 1672,) by means of a cutting pliers, exsected a large fragment (un grand bout) of a fractured fibula near its middle, which had protruded through the skin, and which, without this operation, it would have been impossible to replace in its position. The patient got well in four months, and walked as well as if he had never had the leg broken or lost any portion of bone. The splinters removed from a fractured leg in a case of Dupuytren, (Champion, *Thèse* No. 11, Paris, 1815,) comprised the middle third of the fibula to the extent of three inches, yet the patient neverthe-

less recovered. It is quite rare, however, that exsection of the fibula alone is indicated in fractures; when it is so, the tibia preserves the straightness of the limb.

B. *Exsection of the Tibia.*—The tibia on the other hand, is the bone which surgeons have most frequently had occasion to operate upon under such circumstances. Everybody recollects the history of Paré, (*Liv. XV.*, ch. 23,) and the direction he gave R. Hubert not to spare him and to leave no splinter in his leg. Séverin (Bonet, t. I., p. 317, § 954) had repeatedly performed the operation. In a case of fracture of the tibia from fire-arms a little below the knee, Scultetus (*Arsen. de Chir.*, Obs. 93, p. 362, 1672) exsected a portion of bone the day after, and another on the third day; the first was performed with the cutting pliers, the second with a trephine, (because the fragments wounded the flesh.) Diemerbroeck (*Anatom.*, lib. IX., cap. 1., p. 770; trad. Franç., t. II., p. 604) was called to amputate a leg which had been fractured in the middle part, and where the upper fragment of the tibia had plunged into the earth and was found denuded of tissues and of its periosteum. A skilful surgeon proposed and performed the exsection of the portion denuded which was two fingers in length. The patient recovered without any shortening of the limb. In another case of fracture of the leg the tibia protruded the distance of two fingers in breadth outside the integuments. A consultation being had between Munnicks (*J. Munnicks' Chirurgia*, lib. IV, cap. 44, p. 325, 1715, in 4to.) and three of his confrères, the exsection was performed the day after by means of a saw. The leg preserved its original length, nor could the place be distinguished where the operation had been performed. Four inches of the tibia removed in this manner by Van Swieten, (*Aphorism. de Boerhaave*, t. I., § 343,) did not nevertheless prevent the patient from recovering without any shortening of the fractured limb. The same thing occurred in two patients mentioned by La Motte, (*Traité de Chirurgie*, t. II., Obs. 380,) though one of them had lost eight inches of his tibia. Bagieu (p. 441 à 457, t. II., 1757, *Examiner*, &c.) who opposes J. L. Petit and Duverney, relates at length the case of the Commissary Lavillurnois, who wished him to cut off his leg, but was cured by an exsection upon the tibia. In a case of comminuted fracture of the two bones of the leg, Bilguer (Bilguer, *Dissert. sur l'Inutilité de l'Amputation des Membres*, p. 125, § 36) exsected five inches of the tibia, extracted useless and projecting portions of the fibula, then adjusted the bones, and cured his patient in four months; the leg, though a little shortened, did not prevent the patient from walking or jumping with ease.

Exsection of the tibia, below its middle portion, in a case of oblique fracture, with a riding and protrusion of the bone to the extent of more than two fingers' breadth, was performed on the sixth day by Roueb, (Bazieu, *Examen de plus. Parties de la Chir.*, t. II., p. 516, 1757,) with entire success. Aselmeyer (Obs. sur un Allongement du Tibia, *Gazette Salulaire*, 1763, No. 33) cites another example, as follows:—Compound fracture of the leg, soft parts crushed;

exsection of the tibia, which was fractured and deprived of its periosteum to the extent of five inches; there were found six to seven splinters of the fibula, which were also removed. Six months after the patient walked perfectly well, except, says this author, that he required for this foot a heel a very *little higher (tant soit peu) than the other*. Lieutaud (*Ancien Journ. Méd.*, t. XXV., p. 254, 1766) who, sent for to a case of oblique fracture with protrusion of the tibia to the extent of three or four fingers' breadth beyond the skin, tried dilatation and efforts at reduction, and finally came to the resection of the fragment, makes no mention in this case of any shortening. In the patient of Wilmer, (*Cases and Remarks in Surgery*, etc., London, 1779, p. 213,) with a comminuted fracture from crushing of the leg, exsection and extraction of the whole thickness of the bone was performed to the extent of four inches, yet the patient recovered as it would seem without any perceptible shortening. A person had the tibia fractured by a biscayan, [species of fire-arm,] and the bones were displaced and protruded through the skin. The surgeon, says Theden, (*Neue Bemerkungen*, etc., t. II., p. 44, 1782,) removed the splinters, then sawed the tibia above, below the ligamentum patellæ, and afterwards below at four fingers' breadth above the tibio-tarsal articulation. The fracture apparatus was applied, and exfoliation took place at each end of the bone. The cure, nevertheless, was completed at the expiration of twenty-two weeks. The callus was solid, and there was no shortening.

Exsection of more than two inches from the whole thickness of the body of the tibia succeeded also in a case of Ch. Hall, (Letter to B. Gooch, *Med. and Chir.*, *Obs.*, etc., t. III., p. 79, 1773.) The cure was accomplished in three months, and the callus was completed and ossified at the end of five months. The patient could use his leg very well, and it was but very little shorter than the other. B. Gooch (*Ibid.*, p. 82, 1773) adds in a note, that while he was still at Norwich, he recommended a similar operation, which was attended with the most complete success, and that a series of analogous facts have convinced him of the advantages of this practice. M. Gouraud, (*Demonstr. Principes des Opér. de Chir.*, p. 160,) in the case of a child, whose tibia had been fractured obliquely, exsected an inch and a half of the bone, and cured his patient in thirty-three days without any shortening. M. Champion on the 4th of June, 1838, exsected successfully an inch and a half of the upper end of the tibia, which had been fractured almost transversely, and protruded more than two inches beyond the skin. In a patient operated upon by Dumoulin, *the exsection of the tibia near the articulation of the foot* was followed by *necrosis of the epiphysis*. Bagieu succeeded equally well in the following case:—A transverse fracture of both bones *at one or two lines from the articulation*; the foot thrown outwardly and confined [in this position] (*assujetti*) by the fractured extremity of the tibia after this had pierced through the whole extent of the capsule and skin; reduction was impossible; a lateral incision was first made, and afterwards exsection performed

of the whole of the tibia in order to disengage the foot. There followed inflammation, purulent collections and at various times sequestra of the greatest portion of that part of the tibia which remained fixed upon the astragalus, while the remainder of the bone became denuded (*se fit jour*) at a later period; the cicatrix took place by ankylosis, and the patient was enabled to walk with ease, (*Exam. de plus. Part. de la Chir.*, t. II., p. 441, 1757.) A fracture of the leg, complicated through the imprudence of the patient, with a wound and subsequent displacements, obliged Estor, the father, (*Observation communiquée par Estor même à M. Champion*) to exsect the portion of the tibia which was denuded. At a later period, the epiphysis separated, and was extracted. M. A. Cooper (*Œuvres Chirurg.*, t. II, p. 149) mentions a case of this kind, in which the consolidation of the tibia did not take place, though the fibula remained sound. A similar fact was related to him by Smith.

Josse, (*Bull. de la Fac. de Méd. de Paris*, No. 9, p. 309, 1819,) who exsected two inches of the right tibia which had been completely denuded, says his patient preserved the movements of his foot. The tibia in a case being fractured obliquely below its lower third, protruded to considerable extent through the skin; fruitless efforts were made at reduction, and the soft parts were threatened with gangrene from the pressure of the tibia upon them. An inch and a half of the bone was exsected, and the splinters extracted by M. Maunoir, (*Observation communiquée à M. Champion par l'Auteur.*) The cure, after some inflammatory accidents, was effected in four months. M. Josse (*Mél. de Chir. Prat.*, p. 321, obs. 29) says, his father, in a case, performed exsection upon the tibia, *because the fracture had not yet united, after the expiration of two months and a half, and because the operator was satisfied that nature herself would not effect the union.* Five weeks after the exsection of two inches of the bone, the consolidation was complete.

A fine opportunity of exsecting the tibia escaped M. Champion. There was a fracture of the tibia and protrusion through the skin. The health officer of the place merely applied a simple dressing. M. Champion being sent for to the village, saw the young and unfortunate woman, twenty-two days after the accident. The tibia which had been fractured in its lower fourth, had descended down to a line with the plantar surface of the foot, forming a protrusion of four fingers' breadth, which was covered throughout the whole of this extent with fleshy granulations formed upon its surface. Exsection proposed and agreed to for the following day, was not performed, because the officer of health threatened the family to withhold all assistance from them for ever, if the operation was performed!

C. Exsection of the two Bones.—A man had his right leg fractured transversely at five fingers' breadth above the tibio-tarsal articulation. The ends of the bones protruded more than two inches, and their reduction could not be effected by several physicians and surgeons who had attempted it. They were about amputating the

limb in the solution of continuity itself. Rossius being sent for, remarked that the foot was sound, and that everything else should be tried before proceeding to that extremity, and that they should begin by removing the portions of the bone that were denuded of periosteum. After having excised the projecting extremities by means of a saw with very fine teeth, Rossius replaced the bones by making a moderate degree of extension, and kept them in place by a suitable bandage. The intense pains which the patient had suffered, subsided, some exfoliations took place, and at the end of two months the wound was closed. At the fourth month the patient could walk. When Rossius (*Consult. et Observ. Salut.*, p. 93, 1608) met him in town, the man ran up to him, and expressed towards him the most lively sense of respect and gratitude.

Though this case was published only in 1608, by Victor Rossius, the son of the operator, this operation had been performed a long time before, as one of the posthumous operations bears the date of 1580.

Bilguer, (*Opér. cit.*, p. 25, § 36,) who speaks of a case where the fragments formed a mass of three layers (*à triple étage*) at the lower part of the leg, says that by means of deep incisions, and the exsection of the two bones, a perfect cure was effected. In 1776, a man fractured his leg in the lower third by falling from a horse. The two bones plunged into the ground to the extent of three fingers' breadth. The first dressing was wretched, and left the bones protruding out, and denuded. On the fifth day, the Percys, the father and the son, were sent for, (*Observation communiquée par Percy à M. Champion.*) They performed exsection of the portion in excess from the upper extremities of the fractured bones. Perfect consolidation took place in two months, with a shortening of twenty lines.

D. Operative Process.—If it is the fibula which is fractured, the eversion of the fragments outwards and forwards, almost always allows of our crowding the lateral peroneal muscles backwards, and the anterior muscles of the leg inwards. Though there are no large-sized arteries nor nerves in the neighborhood, we must, nevertheless, raise up each fragment, and keep it so by means of a piece of pasteboard, &c., (plaque protectrice) glided under it, while with the saw directed obliquely, we exsect the upper fragment from above downwards, and the lower one from below upwards.

In the case of fracture of the tibia, the operation is usually more tedious. This bone, besides being in itself much thicker, and in the neighborhood of the anterior and posterior tibial arteries, is also sometimes difficult to turn into the direction which is most suitable. We should not, therefore, spare our incisions into the skin, when we are about to exsect it. As the fibula, however, possesses a certain degree of flexibility, we may, by acting on the foot, which is to be inclined backwards, outwards, or forwards, according as is required, give ourselves in most cases considerable room, and bring into view, without much difficulty, that portion of the bone which we wish to remove. Though it will almost always

suffice to exsect the protruding portion of the upper fragment, we are not, however, to respect the lower one if it should project out too far, (*très allongée*,) and if we can reach it without too much difficulty. Oblique fractures of the tibia so rarely recover without deformities, and so often leave under the skin, after their consolidation, a point or crest which gives occasion to incessant trouble to the patient, that we ought never to hesitate to remove the projecting portions so often as they are complicated with wounds.

As with the fore-arm and arm, so after exsection of the bones of the leg in cases of fracture, the starch bandage is an invaluable resource; and, as with the thoracic extremity, so is it equally necessary here that openings should be left in this dressing opposite to each one of the wounds.

§ VII.—*Exsection of the Femur.*

We already find in Paré (*Liv. II., chap. 5.*; Bagieu, t. II., p. 509) the case of a M. de Croy, who, having had the splinters which were in his thigh removed, got well of a fracture of the femur, with the exception of a slight defect only in the movements of the knee. An officer of sixteen years of age, had both femurs fractured; the right one was shattered to the extent of about four inches; the lower fragment resembled a fork; the upper fragment, in spite of what was broken off from it, and the five pieces that were taken from it through the wound, rode so strongly on the other, that its reduction was impossible. Amputation would have been performed, had not Lauquine (*Journal de Verduin*, Avril, 1733, p. 97, 240) found on the fore-part of the upper fragment a fissure which penetrated into the medullary canal, and extended upwards to five or six fingers' breadth from the hip, a little below the great trochanter. The fever and diarrhœa exhausted the patient. On the twenty-eighth day the wound was dilated, and the upper fragment sawed up to above the fissure. The portion sawed off, and those extracted, comprised *nine inches* of the body of the femur, leaving only about ten to twelve fingers' breadth of this bone remaining. The accidents ceased; on the third day permanent extension was made, and a fracture box adjusted for the lodgment of the limb. The cure was effected in seven months, with a shortening of *two inches*. The patient could walk with firmness. Exsection, also, had to be performed in the two following cases:—Fractures of the two femurs; protrusion of the lower fragment through the flesh in a negro boy of twelve to thirteen years of age, attacked with tetanus. Reduction was in vain attempted by the surgeon Philibert, (Poupée-des-Portes, *Mal. de St. Dom.*, Obs. 2e, 1770.) A containing bandage was applied for 24 hours. At this period, an end of bone about an inch long was extracted. Some days after, the same thing was done on the other thigh, with this difference, that the portion of bone which protruded had at least three inches length. After the extraction of the sequestrum, the muscles seemed more pliant; Philibert could now return the feet from without inwards, and place them

in their natural position. The cure was complete. The negro did not limp; the thighs were only a little arched in their upper portions, which made him walk too spreading, (*trop ouvert*.) On the upper and outer lateral part, there was still felt near the great trochanter on each side, a rough and irregular swelling or slope.

Operative Process.—To exsect the femur in cases of fracture, it is absolutely necessary to make the fragments protrude either in front or outwards. We begin with the upper fragment first. An assistant grasps the side of the upper part of the thigh. A second assistant supports the leg and the knee, which he inclines in an opposite direction. After having sufficiently liberated (*débridé*) and isolated the organs, and placed a protecting body between the bone and the soft parts, the surgeon grasps the point of the fragment with his left hand in order to exsect with the saw placed in his right. Proceeding, afterwards, to the removal of the end of the lower fragment, he operates precisely in the same manner. At the upper third of the thigh, however, it would be more convenient to begin by exsecting the lower fragment, seeing that the upper one tends to conceal itself on the inside or in front, while the point of the other projects outwardly. The starch dressing here also co-operates as a containing bandage, in the success of the operation after the exsection.

§ VIII.—Other Cases.

The *immediate* exsection of the ends of bone protruded through the flesh is not always possible though indicated, as for example in the *intra-uterine* fœtus. The tibia was separated from its lower epiphysis in an infant of six months' pregnancy. At birth the upper fragment passed through the skin in a direction outwardly. It had lost its periosteum and presented a bad aspect. Attempts at reduction were abandoned because the borders of the wound were attacked with gangrene, and that necrosis had begun to make its appearance. The disease rapidly extended, and death took place on the thirteenth day, (Carus, *Arch. Méd.*, t. XVI., p. 414.) Would not exsection have saved this infant?

M. Schubert (*Jour. des Progrès*, t. VII., p. 247) speaks of an infant born at its full term, and whose left thigh, fractured and carious, protruded through the flesh to the extent of more than an inch. In the case of an oblique fracture of the bones of the leg in a fœtus, the pointed extremity of the fragment of the tibia pierced through the skin. The two bones, moreover, were adherent at their fractured extremity, so that they formed a large surface, (*Jour. de Hufel.*, &c., *Jour. Comp.*, t. XXVIII., p. 330.) Exsection would also be advisable if one of the ends of bone, caught in the medullary canal of the other, should occasion accidents and could be diagnosed. J. L. Petit ascertained on the dead body that one of the ends of the femur had caught in the medullary canal of the other, that consolidation had taken place, and that the limb was lengthened near an inch. M. Roux (*Malad. des Os*, edit. de Lorus) also in a

case of fracture, in order after exsection to keep the ends of the bones united to each other, effected the invagination of the lower end of the humerus into the medullary canal of the upper fragment, without its being followed by any unpleasant consequences. A fall on the arm, however, at the expiration of two months, marred the success of this operation.

§ IX.—*Bones of the Pelvis.*

The cases that might require exsection in fractures of the pelvis are not by any means rare. In the case of a boy aged fifteen years, who had been crushed against a stone butt (borne) by the wheel of a diligence, I was obliged to exsect an inch of the right pubis which protruded through the skin. I was obliged, also, in a man whose pelvis had been fractured by a carriage, to remove the whole of the tuberosity of the ischium; and I have frequently removed an inch or two of the crest of the ilium in consequence of similar injuries. It is rare, however, that the operation will succeed in this region, because the internal organs are injured (*altérés*) to such extent as to leave no hope of preserving life. I have, however, seen two individuals recover after the excision of the upper border and anterior spinous process of the ilium.

ARTICLE II.—NON-CONSOLIDATED (*i. e.*, UNUNITED) FRACTURES.

Sometimes in fractures consolidation will not take place. The two ends of the bone become rounded off, and an abnormal joint (*brisure*) is formed in the continuity of the limb which almost totally destroys its functions. Some authors, in order to remedy this accident, have proposed to place the limb in a state of complete immobility, and to employ certain kinds of apparatus for a great length of time. Others have supposed that it would be better to pass a seton through this species of morbid articulation. Others again confine themselves to producing friction of the ends of the bone against each other in order to create inflammation. *Sommé* has succeeded by passing a silver thread around the intermediary substance of the joint so as gradually to effect its division. *M. Hartshorne* has been equally fortunate in destroying it by caustic potash also introduced upon the extremities of the fragments. But in such cases, exsection is, as we shall see, the resource which offers the best chances of success. *White*, who attempted it first in 1760, in a case of non-consolidated fracture of the humerus, in which he brought the two ends out and sawed them off, and in another case afterwards in the tibia where he confined himself to exsection of the upper end, obtained perfect cures in both his patients. *M. Viguerie* and *M. Langenbeck* have met with similar good fortune in fractures of the arm by following the method of *White*. *Dupuytren* confines himself to exsection of the upper end, and to rasping (*ruginer*) the other. *Bowlans*, *M. Pezerat*, &c., have also performed this exsection with success in ununited fractures of the thigh. Some other

surgeons have not been so fortunate; MM. Larrey, Richerand, Boyer and Physick, relate cases where it has been followed by serious accidents and even by death. So that we should not decide upon it until after mature reflection, and after having satisfactorily ascertained that the operation is necessary; so much the more so, as the difficulty for which we perform this operation is sometimes reduced to an infirmity which can be supported by the patient. In the thesis of M. Caron, we have an instance of a man who had one of these fractures in the thigh, and who could walk without crutches. In the patient of M. Kulnholtz, (*Journal Compl. des Sc. Méd.*, t. III.,) the false articulation was complete and scarcely affected the functions of the limb. M. Cloquet (*Arch. Gén. de Méd.*, t. XIX., p. 619) mentions a case in which the upper fourth of the humerus had been for a long time destroyed, but without impeding thereby the motions of the arm. M. Yvan (*Ib.*) relates a similar case of the thigh. M. Troschel (*Journal des Progrès*, t. X., p. 257) mentions three cases of this kind who were enabled to walk with ease by using the double gutter of tin, constructed by the manufacturer Baillif. I have myself seen at the Central Bureau a woman with one of these fractures in the right thigh, and who is enabled to walk without crutches by means of an apparatus, though of a very rude construction. Analogous facts are referred under the head of *Deformity from Diseases of the Bones*, (Vol. I.) The surgical treatment therefore of false articulations is exceedingly complex, and requires to be examined in all its parts considered separately.

[*Effect of Utero-gestation in Fractures.* Among the causes which may retard or prevent consolidation is the state of pregnancy. Every one is familiar with the fact that pregnant women are peculiarly prone to fractures; but a case is related, (*Provincial Medical Journal*, (Eng.) Sept. 3, 1842—see also Cormack's *London and Edinburgh Monthly Jour.*, &c., Feb., 1843, p. 160,) in which a woman, a native of the West Indies, had fractured both bones of the right leg near the middle, Sept. 23, 1839, in the eighth month of her pregnancy. No pain or action supervened in the part, nor any union, the interval between the fractured surfaces being occupied by a pulpy substance, until a few days after, Sept. 28, when the mother having had a comfortable labor, the work of ossific reparation now commenced, accompanied with pain, and effected a complete cure by January succeeding. The narrator of the case, Mr. H. R. Oswald, considers that the completion of the child was the cause of non-deposition of earthy matter in the mother's leg. If that were true, why, when this process of building up the child's bones and tissues is in such active operation as it is during utero-gestation, should there actually be an apparently disproportionate preponderance of earthy over gelatinous matter in the bones of the mother? for, as in this case, it is precisely then that the bones are most brittle, *i. e.*, surcharged with phosphate of lime, and the reverse of mollities ossium or a preterabundance of animal glue, &c. The more probable fact is, that if observation were attentively directed to this process it would be found that fractures more frequently hap-

pen to the mother in the earlier months of pregnancy, when more glutinous matter is required for the fœtus and the mother's own osseous system therefore probably called upon occasionally by the absorbents for a supply of this material. Hence the brittleness then of her bones from too great a proportion of earthy matter. The suspension of any new reparative action whatever in the mother during utero-gestation is readily conceived of as a physiological result quite natural and possible.

Statistics of Fractures.—According to a statistical table of 196 cases of fracture at the Royal Infirmary of Glasgow, (Cormack's *Lond. & Edin. Monthly Journ., &c.*, 1844,) by Mr. W. Lyon, many of the received notions on the age and class of persons most liable to such injuries, and the results that ensue are to be taken with much qualification. Mr. Lyon says the average age at which fractures are most common to women is a little over *forty-one years*, and that of men a little over thirty, which may in part, perhaps, be explained by the fact that more women reach the period of old age than men, and from their general constitution and also their bones being feebler.

The cure, too, he asserts is quicker in women, viz., near four weeks in them, and over five in men, which seems entirely in contradiction to the fact that fractures occur at a later period of life in the former, and that consolidation therefore ought to be more tardy. But it is to be recollected that fractures in women are seldom comminuted or accompanied with contusions.

Contrary also to the received notions, Mr. Lyon says the number of fractures was greater during the warm months of July, August, September and October, (viz., 63 cases,) than during November, December, January and February, (viz., 55 cases.) But the cool months in Scotland of March, April, May and June, *i. e.*, one quarter of the year are left out of the calculation. Besides, in a placelike Glasgow, of extensive commerce, there must be more trade, and consequently more casualties among laboring men at and on board the shipping, in ship-building, &c., in the mild than during the cold season of the year. (See a note in Vol. I., on the Influence of Seasons on Wounds.) T.]

§ I.—*Friction* (Frottement or rubbing) of the *Fragments*.

A fracture will sometimes fail to unite because it is in want of the degree of stimulation requisite for the production of the callus. The limb then appears shrunk (*étioilé*) and enfeebled, and in some cases assumes the aspect of organs affected with what M. J. Cloquet (*Archiv. Gén. de Méd.*, t. I., p. 470) has described under the name of *Local Scorbutus*. Among the patients whom I have seen in this state, there were many of them who were young and robust subjects. The usual causes of this condition are want of exercise, and the compression (compression) of the blood between the fragments. Time, the removal of all dressing, and a nutritive (substantial) diet, and some frictions to the ends of the bones, generally suffice to bring about a cure. Like Earle and M. S. Cooper, I have also noticed in such cases, that by leaving the limb without dressing, the con-

solidation will often ultimately take place of itself; whether the stimulus of necessity augments the activity of the ossific process, as Hunter, (*Trans.*, t. XII., *et Mém. Chir.*, etc., t. I., p. 383; S. Cooper, *Dict. Chir.*, t. I., p. 480, coll. 2,) expresses it, or that relieved from all kind of uneasiness and pressure, the parts immediately become the seat of a more active nutrition, or that the slight rubbing together of the ends of the fragments against each other, caused by the muscular movements, create the degree of irritation which the callus stands in need of.

If this repose and the absence of dressing continued for a length of time do not answer, we can then have recourse to actual frictions, (*véritables frottements*.) In the lower extremities we first endeavor to effect these by the action of walking. Ch. White (*Cases in Surgery with Remarks*, p. 73) cured a fracture of the thigh by means of a cuish and the exercise of the limb. In a case of fracture of the leg at the lower part, and which had not consolidated after two months and a half of treatment, I effected a perfect cure by making the patient walk by means of crutches. I was led to this practice, says M. Champion, by the emaciation of the limb caused by the pressure of the dressing. The same practitioner also adds that M. Jacquier of Ervy, promptly cured a fracture of the tibia by making his patient walk. It is a practice which I often follow at La Charité, and I find it answer very well.

Direct friction, which was already in use at the time of Celsus, (*De Re Med.*, lib. VIII., cap. 10, sec. 9,) has often been made trial of since. Though Borm, (A. Bérard, p. 43, *Thèse*, 1833,) Germain, (*Procès-Verbal de la Soc. des Sciences de Liège*, p. 57, 1773,) M. Hain, (Vallet, *Non-consolid. des Fract.*, Strasbourg, 1817,) Ansiaux (*Clin. Chir.*, p. 323, 2d ed.) and others may have seen it fail; Deracagnaux (in the leg, *Journal de Corvisart*, an IX., p. 314,) MM. Vogel, (In the clavicle, *Diss. Medico-Chirurgicale*, sur le Seton, p. 11, Strasbourg, 1815. The cure attempted in the sixth week by a surgeon-major.) Parrish, (*Arch. Gén. de Méd.*, 2e série, t. VI., p. 569,) Base Dow, (*Graefe und Walther, Journal*, t. XVII., p. 438,) Sanson, (*Dict. de Méd. et de Chir. Prat.*, t. II. p. 508,) and Delpech, (*Clin. Chir.*, t. I., p. 250, 1823,) have related instances of its success. It is a resource, therefore, that may be made trial of in spite of the sort of anathema fulminated against it by Boyer, (*Malad. Chir.*, t. III., p. 106.) The skin being unaffected, the fragments, when rubbed against each other, will not produce any serious accidents, nor lead to the formation of abscesses, unless they are moved without skill or method. Before proceeding in such cases to an actual operation, I would, instead of the small blisters eulogized by Walker, (*Journal de la Soc. de Médecine*. A. Béclard, *Thèse*, p. 43,) willingly apply a temporary blister (*vesicature volant*—See Vol. I.) large enough to envelop the whole contour of the fracture.

§ II.—*Compression, Immovable Dressing.*

If the pseudarthrosis, in place of being kept up by the shrinking

and feebleness of the limb, appears to depend upon an excess of irritation or tumefaction, it is then possible that the compression which M. Wright (*Jour. des Prog.*, t. XV., p. 88,) says he has found so advantageous, may in fact be found serviceable. Nevertheless, I can scarcely understand, nor are M. Wright's observations calculated to demonstrate, how this alone can cure a false articulation. The cures which are imputed to it, depended probably upon a more complete state of immobility having been given to the limb, than had hitherto been attained up to that time. To effect that object we must have recourse to the starch bandage. This last resource must be made trial of before all others, and offers real chances of success, in cases where during the treatment we have never had it in our power to subject the non-united fracture to a state of perfect immobility. Science possesses on this subject facts that are already numerous and conclusive. Non-consolidated fractures of the thigh and arm, and of the leg and forearm, have been cured by means of the starch bandage, by M. Larrey, M. Bérard, jun., and M. Macdowel, (*Jour. des Connaiss. Medic.*, t. II., p. 123.) A patient whose fore-arm, by the advice of Rust (*Journ. des Progrès*, t. X., p. 259,) had been enveloped in Baillif's machine, solely with the view of rendering the false articulation less annoying, was astonished to find himself cured at the expiration of three months when he was about to renew the dressing. A woman who had had a false joint for more than a year, was cured in two months by M. Thierry, (*Expériences*, t. I.) by the application of the starch bandage. Having been in the employment of this bandage since the year 1836, I have satisfied myself that it enables us to cure without any other operation, the great majority of those false articulations which succeed to fractures. A woman aged thirty-nine years, who already had a non-consolidated fracture of the thigh, broke her arm. The ordinary dressings were made use of for two months, without any benefit. I then applied the dextrine bandage, and the consolidation was effected completely. Mme B * * *, whose humerus had been fractured thirty months before, and continued movable, notwithstanding the treatment of many distinguished surgeons of the capital, and the employment of all sorts of bandages, made up her mind, in May, 1838, to make trial also of the dextrine bandage. A roller bandage was placed naked over the whole extent of the limb and fastened by a spica around the chest. Over this were then placed two layers (plans) of turns of bandage with pieces of pasteboard saturated with dextrine; the whole soon becoming dry was left without being disturbed for the space of two months, when at the expiration of this period, to the great surprise of this patient, who no longer looked forward to a recovery, the fracture was found consolidated upon my removal of the bandage. The same thing occurred in a pseudarthrosis of the thigh of ten months standing, and of which I have already spoken under the chapter on Deformities, (Vol. I.)

By means of this bandage therefore, properly applied, we may count upon the cure of all those false articulations, which are not

the result of a want of excitation or of general disease, or a degeneration of the fragments, but which have been brought about by the defect of the means to be employed to produce proper compression. It ought also to be classed under the head of the auxiliary means, or fracture apparatus, to be used after the different varieties of operations of which I am now about to speak.

§ III.—*The Seton.*

The seton which was used to the fore-arm without a successful result, by Cittadini, who proceeded afterwards to the exsection of the ulna; and to the humerus in a case related by Lombard (*Thèse* No. 377, Paris, 1814;) again to the humerus, by Earle (*Trans. Med.-Chir.*, t. XII., *et Mémoires de Chir. Etrang.*, t. I., p. 376,) who substituted potash for it without any better success, effected its purpose but imperfectly when applied to the femur in a patient of M. Brodie (*Journal Analyt. de Méd.*, t. I., p. 277, 1827,) and to the patient mentioned by M. Wardrop (*Mém. de Chir. Etrang.*, t. I., p. 350.) Bécларd (*Vallet*, p. 25,) of Strasbourg, also only obtained partial success from it in using it to the humerus; while Ansiaux and M. McDowel (*Journ. des Conn. Méd.*, t. II., p. 123,) in similar cases failed with it completely. It is a resource nevertheless deserving of commendation in all sorts of fractures. Thus Rigal de Gaillac (*Société Méd. de Montpellier*, Juin, 1812,) by this means cured an ancient fracture of the leg. A similar cure was obtained by M. Mott (*New York Medical and Surgical Register*, Vol. II., p. 374,) and another has been published by M. Browne (*Bulletin de Férussac*, t. XXI., p. 268.) Horner (1812—*Vallet*, p. 24,) succeeded with this operation upon the humerus. Delpech (*Clin. Chir.*, t. I., p. 255,) effected a cure by this means in the fore-arm, 86 days after the fracture, and M. Ducachet (Bérard, *Thèse*, etc., p. 46,) at the expiration of ten months. A false articulation with a fibrous (filamenteuse) exudation had been formed, while there existed at the same time an abscess (dépôt) in the calf. By means of a tunnel-shaped wound, M. Weinhold (*Bull. de Férussac*, t. XI., p. 66, 1827,) introduced a conical formed seton into the false articulation, and cured his patient. A pseudarthrosis which had existed in the right femur for ten years, accompanied with fistulas and caries, was cured by the same means in the space of three months, and it succeeded equally well also in another case of false articulation of the femur treated by M. Pl. Portal, (*Encyclograph. Méd.*, 1836, p. 311.) Non-consolidated fractures of the humerus have been cured by means of the seton by Physick, (A. Bérard, *Opér. cit.*, p. 45,) Percy, (Laroche, *Thèse*, Paris, 1805,) Dohldorf, (*The Lancet*, 1829, Vol. II., p. 105,) Stanfield, (Bérard, p. 45,) Pl. Portal, (*Encyclograph.*, 1836, p. 311,) and M. McDowel (*Journ. des Conn. Méd.*, t. II., p. 123.) Physick also is of opinion that he cured in this manner a fracture of the jaw, which had existed for two years. It is nevertheless a very uncertain means, and one for which I should prefer to substitute exsection, where frictions and

the starch bandage had not answered, and it is one moreover which is not always unattended with danger. M. Weinhold in applying it to the neck of the femur brought on caries and suppuration in the cotyloid cavity and pelvis, which ended in the death of his patient. M. Harris, (*Arch. Gén. de Méd.*, 2e sér., t. X., p. 220, 217,) however, states, that in using it to the fore-arm in one case after exsection, and to the humerus in another, he effected a cure in both. M. Viricel (Montfalcon, *Mém. sur l'Etat Actuel de la Chir.*, 1816, p. 195,) after having abraded (*rafraichi*) the osseous surfaces with a file, introduced a seton according to the mode of Physick. The greatest care bestowed upon the patient could not save the patient from death. He died a few days after the operation. M. Seerig (*Encyclogr. des Sc. Méd.*, 1838, p. 33,) who succeeded with the seton in one case, was obliged to resort to exsection, and in a second case lost his patient.

§ IV.—*Caustics and Rasping*, (rugination.)

Earle, after having rasped the humerus, applied caustic potash to the bottom of the fracture, (*Méd.-Chir. Trans.*, t. XII., and *Méd.-Chir. Trans.*, t. I., p. 384.) There was no exfoliation took place, nor was there any reparative action established.

M. Hewson, (*Journ. des Progrès*, t. IX., p. 170,) by excising the ligamentous tissues, and cauterizing in the same manner, effected a cure of a false joint in the leg. M. Lehmann (Bérard, *Thèse*, p. 42) succeeded equally well by applying butter of antimony to the tibia. M. Hulse (*Gaz. Méd.*, 1834, p. 246) asserts that he has succeeded equally well by using simple irritating injections, and M. Mayor (*Nouveau Syst. de Délig.*, p. 168, art. 2) procured the consolidation of a fracture of the femur, by introducing upon it through a canula, a punch (*mandrin*) heated to the temperature of boiling water. M. Hartshorne also asserts, (A. Bérard, *Thèse*, p. 41,) that the application of caustic upon the skin is sufficient to ensure success. But all such remedies are inferior to the seton. According to Verdue, (*Path.*, t. I., p. 412,) the cauterization, by means of sulphuric acid, (*esprit de vitriol*), of a callus, mistaken for a fungus, caused the death of the patient in six months. M. Barthélemy, (*Diss. de Montpellier*, et *Vallet*, p. 31, who describes the instrument,) who, in 1814, proposed a *grater* (*râpe*) in form of a saw, to be passed through a canula to the fragments, in order to scrape (*racler*) the ends of the bones, would incur the same danger. A case of fracture had existed in the radius for the space of a year. An incision was then made down upon the bone. Edsford (*Journal de Simmons*, trad. par Masuyer, t. I., p. 405) then divided the periosteum, and removed it to the extent of an inch above and below the fracture, without disturbing the fragments. Inflammation and consolidation succeeded, and the patient was perfectly cured at the expiration of three months.

[*Acupuncture for Ununited Fractures*.—M. Weisel (See *Medical Times*, Jan. 11, 1845) cured an ununited fracture of both bones

of the fore-arm, by *acupuncture* with two long needles, first passed through the arm between the fragments of the ulna, and left in five days till acute inflammation was produced; and secondly repeating the same operation in 15 days after, between the fragments of the radius. T.]

§ V.—*Exsection.*

A. Exsection, however much lauded and practised by an infinite number of surgeons, in cases of ununited fractures, is, nevertheless, still censured by M. Gouraud, (*Elémens des Prin. Opér.*, p. 164,) who considers it a retrograde movement in surgery. Sometimes, in fact, it becomes a very serious operation. In a case of exsection of the two ends of a femur, communicated by M. Gable to M. Vallet, (Vallet, *Thèse*, p. 29,) it was barbarous, (cruel,) and lasted over an hour; the patient, a young and vigorous man, had convulsions, and died in the evening. Though Callisen (*S. Cooper*, t. I., p. 478, et suiv.) relates two examples of success, Cline (*Ibid.*, p. 482) states that with him the operation had failed. The patient upon whom M. Langenbeck succeeded, had a false articulation of the humerus. It was the same with that of M. Rodgers, (Rust's *Handbuch der Chir.*, p. 541,) and that also of M. Fricke, (*Gaz. Méd. de Paris*, 1787, p. 155.) M. Dupont (*Arch. Gén.*, t. II., p. 628) was not less fortunate in a similar case, and M. Liston (*Edinburgh Medical and Surgical Journal*, Vol. LX., p. 317) also cured his patient. But in a multitude of other examples, serious accidents have supervened, or the result of the operation has been unsuccessful. A patient operated upon by Boyer, (*Boyer*, t. III., p. 111,) died from gangrene of the arm. Dupuytren lost one of his in consequence of inflammatory symptoms, (Bérard, *Thèse*, p. 52.) Another patient (*Gaz. Méd. de Paris*, 1831, p. 289) still retained his false articulation four months after the operation. The young man operated upon by M. Hewson, (*Arch. Gén. de Méd.*, 2e sér., t. X., p. 225,) died from purulent infection. Though Andrew (*Journ. de Méd.*, par Simmons, 3e part., 4e sect., t. I., 1781,) communicated to Hunter, the details of a remarkable operation of this kind, which he performed with success upon a fractured arm, and though Physick (*Medical Repository*, of New-York, t. VII., p. 122, 1804) was witness to a similar success, we see that in the patient of Rossi, (*Elém. de Méd. Opér.*, t. II., p. 190,) a ball was found in the fragment above the part exsected, and that it became necessary to resort to amputation; and that in the case of Ausiaux, (*Clin. Chir.*, p. 323, 2e édit., 1829,) friction, the seton, and excision all proved unavailing. Nor was M. Moreau (Champion, *Thèse de Paris*, 1815, No. 11, p. 51) more fortunate. But this process applied to the tibia by White, (*Cases in Surgery*, p. 81–84, 1770,) M. Harris, (*Arch. Gén.*, 2e sér., t. X., p. 215,) and A. Dubois, (Foussard, *Dissert. sur les Fractures*, p. 41,) has succeeded very well.

In a case of pseudarthrosis of both bones of the fore-arm, Cittadini (*Journ. Complém.*, t. XXXII., p. 157) was enabled to effect a

cure by exsecting the ulna only. MM. Fricke, (*Ibid.*,) Holscher, (*Dict. de Chir.*, de Rust,) and Inglis, (*Edinburgh Medical and Surgical Journal*, Vol. LX., p. 317,) have been equally fortunate with M. Cittadini, in non-consolidated fractures of the same portion of the limb. But with M. Warmuth, (*Dict. de Rust*, p. 544,) and M. Harris, (*Arch. Gén. de Méd.*, 2e sér., t. X., p. 217,) this exsection failed. Another surgeon (*Mém. Acad. Chir.*, t. X., p. 84, in 12mo; t. IV., p. 626, in 4to,) sawed off more than a finger's breadth of the lower end of the femur, and cured his patient. Dupuytren (Sabatier, *Méd. Opér.*, t. IV., p. 461, edit. Bégin,) and Moreau, the younger, (Champion, *Traité de la Résection*, etc., p. 67, 1815, &c., et Moreau, *Essai sur l'Emploi de la Résection des Os*, p. 72,) also succeeded upon the femur.

The operation on the femur succeeded also with M. Viguerie, (S. Cooper, *Dict. de Chir.*, t. I., p. 481,) M. Pézerat, (*Jour. Compl.*, t. V., p. 111,) with Dupuytren, who gives two examples of it, (Bérard, *Thèse*, p. 51,) and with M. Mott, who had recourse to it when the seton to which he gives the preference, and with which he has succeeded in three instances, proved insufficient; but we have seen farther above that this exsection has frequently failed. The patient of M. Harris (*Arch. Gén.*, 2e sér., t. X., p. 215) did not recover until after eight or nine attacks of erysipelas, and a year's treatment, while that of M. Hewson (*Ibid.*, p. 225) died on the sixteenth day.

This operation performed also by Halgout (*Essai sur l'Amput. des Membres*, par Lambert, Paris, 1815,) of Boulogne, in presence of Percy, in the year 1803, for a fracture of five years' standing, by making a long incision on the outer side of the limb, also failed. Death, preceded by fever and suffocation, and without any action of consolidation, took place at the end of a month. Before the operation the patient could walk only by the aid of crutches, and the thigh seemed to be held only by the skin.

In a case of non-united fracture of the patella which had existed a month, it was the intention of M. A. Séverin, (*Corps de Méd.*, etc., de Bonet, t. I., § 953,) had the patient consented, to have pared and abraded the edges of the fracture, before *tying them tightly* together against each other. M. A. Séverin calls this operation harsh and difficult! (rude et fâcheuse.) Should the pseudarthrosis be accompanied with a sequestrum and necrosed splinters between the fragments, we may confine ourselves to removing them, taking care at the same time to avoid the other portions of the bones. Faivre gives an example of this upon the leg (*Ancien Journ. Méd.*, t. LXVIII., p. 210;) the fracture had existed 7 months, and suppuration had taken place; some splinters, and one portion of the whole thickness of the bone of an inch and a half in diameter, were extracted; the parts were then cauterized with the hot iron, and the cure thus effected.

Here is another case: A man had the humerus on the right side fractured into splinters on its lower third by the discharge of a leaden ball, which penetrated on the inner side of the arm. Three splinters of bone were extracted, which came from the inner and

posterior portion; after some days had elapsed, splints were applied. The surgeon consulted 4 months after, found a sinuous wound, a number of sequestra and a sufficient degree of mobility at the place of the fracture. Having laid open the fistula above and below, he extracted several pieces corresponding to the inner and anterior surface of the humerus, to an extent of sixteen lines. The finger could enter the medullary canal of the two ends of the bone, and bring away marrow in a state of dissolution, (*de la moelle en dissolution.*) A sort of provisional or temporary (*provisoire ou d'attente*) callus, which had already formed in front and on the outer side, though the arm was flexible, gave assurance of a perfect consolidation in a short space of time.

B. Appreciation.—We see from the examples which Science is already in possession of what we have to hope for in practice from exsection of the bones in cases of ununited fractures. Wherever the pseudarthrosis is sustained by some constitutional disease in the individual, the operation will be unattended with success. There will be a chance of success on the contrary when there is an hydatidic (*hydatique*) affection of one of the bones, of which Dupuytren has met with an example (*Journ. Hebdomadaire*, t. XII., p. 97,) or where some carious or necrosed point of the extremity of the fragments, is the only impediment to the formation of the callus. It would also be the only efficacious resource in an ancient oblique fracture, where the point of one of the extremities of the bone, had become imprisoned (*engagée*) in the thickness of the muscles, as happened in the patient of M. Earle, (S. Cooper, *Dict. de Chir.*), in one of those of Dupuytren, in that of Boyer, and as it would seem in that also of M. Pézerat. If the fracture, whatsoever may have been the primitive cause, shall have become reduced to an affection altogether local, and shall have not united purely because its two fragments have cicatrized separately, then also is exsection still the most efficacious remedy. Nevertheless, we should never decide upon this step until we have maturely considered all its dangers. Being under the necessity of penetrating into the centre of the limbs, and of detaching and dissecting the muscular tissues to a very considerable extent, we transform the infirmity into a fresh compound fracture with a deep wound. From whence the danger of suppurations, erysipelas, inflammations of all kinds, caries, necrosis, and even purulent infection or phlebitis, as is proved by the facts collected by M. Kirkbridge, (*American Journal of Medical and Surgical Science*, November, 1835,) and those of M. Troschel, (*Encyclograph. des Sc. Méd.*, p. 33.)

C. Operative Process.—The difficulties of the operative process in exsection of the bones in cases of false articulations, are very different in different parts of the limbs.

I. Bones of the Fore-Arm.—If the pseudarthrosis should be situated in only one of the bones of the fore-arm it would be unnecessary to perform exsection. When this operation is indicated, there is at first an arrangement in the limb which allows of its being easily inclined in one or another direction. It is unnecessary to

add, that where there are wounds or fistulas connected with the fracture, we should, in order to reach the bone, confine ourselves to their dilatation, unless they should be too unfavorably placed for our doing so. In the contrary case, which will be found the most common, we should make an incision upon the integuments on the most superficial surface of the ulna or radius. The bistoury, therefore, should be applied upon the posterior and inner side of the fore-arm for the first of these bones, and to the outer and slightly to the posterior side for the second. This incision, whose middle should correspond to the fractured part of the bone, ought to have an extent of two to three inches. In order to detach gently all the soft parts which adhere to the bone within and without, the surgeon places the arm in a state of flexion, and thus brings out to the external surface the two ends of bones to be exsected. If there is found to exist between them a solid bridge, we can, after having detached the soft parts from them, easily glide underneath a small splint, which will serve as a support, while we in the mean time successively remove, with the saw, the two portions of osteo-ligamentous substance. The same operation having been performed upon the radius, where a little more precaution is necessary, to avoid the artery and tendons of the thumb, the limb, after having arrested the hemorrhage and cleansed the wound, is straightened and placed in an immovable bandage and then dressed in the same manner as if it was a recent fracture.

II. *Humerus*.—If the fracture of the arm should be situated upon its middle portion, the incision should by preference be made on the outer side of the limb; in which place it would implicate only the integuments, cellular tissue, aponeurosis, and a few branches of nerves. The cephalic vein, besides, could be easily pushed aside. At the lower fourth of the humerus, however, we should have to be on our guard against the radial nerve. In order to divest the points of bone of the tissues which adhere to them, it would be necessary to graze very close, and not to come too much in front, for fear of wounding the brachial artery and median and ulnar nerves.

If the fracture should be situated near the elbow, it would be better to make the incision on the posterior surface, taking care not to go down as low as the synovial cavity, but to prolong the cut a little more above. If the longitudinal division of the triceps should not suffice, there would be little danger in uniting to it a transverse incision on one or both sides of it. If, in bending the arm on its anterior face, there should be more difficulty in making one of the fragments protrude than the other, it would be prudent first to exsect that which presents itself and to dissect and saw the other afterwards, after having brought it out by means of a hook, or lever, or the fingers.

In the upper fourth of the humerus, a false articulation could be reached only through the deltoid muscle. It is in this place that the operation might be exceedingly embarrassing, and attended with real dangers. Dupuytren, (*Gaz. Méd.*, 1831, p. 289,) in making an incision of six inches for an affection of this kind, encoun-

tered serious difficulties. Accidents supervened, and four months after, the false articulation was still there.

III. *Clavicle*.—A false articulation in the clavicle is not to be treated by an exsection of the bones. A patient, whom I have met with, and who had this infirmity from infancy on both sides, experienced no inconvenience from it, and could perform without difficulty the most severe labors. M. Lanctuit (*Thèse de Strasb.*, Avril, 1823) says that M. Bouchet saw a patient in whom half the clavicle was wanting, but whose corresponding arm, nevertheless, was not wanting in vigor and activity. If, however, contrary to all probabilities, a fracture of this kind should be transformed into an annoying malady, and exsection should be decided upon, the surgeon would make a horizontal incision on the antero-superior surface of the bone; as the subclavian vein is found directly underneath, it would be advantageous to draw the ends of the fracture forwards, by means of an elevator (levier) or blunt hook, and to hold them in this raised position until the saw should have exsected them.

IV. *The Leg*.—It is in the leg that exsection for pseudarthrosis is attended with the greatest degree of embarrassment. The tibia should always be laid bare on its antero-internal side. We cautiously detach the muscles behind and on the outer side, grazing as close as possible to the posterior surface of the bone, in order to avoid with greater security the corresponding posterior tibial artery. In the upper half of the tibia, it would be difficult to perform exsection without joining a transverse incision to the longitudinal one. But perhaps a single incision, however, would then answer, if we gave an oblique direction to it from above downwards and from before backwards. The exsection of one of the ends of the bone having been completed, we could proceed to the other also through the same wound.

In order to lay bare the fibula, it would be necessary to penetrate between the peroneus longus and brevis and the extensors of the toes, for which purpose a single incision will always be found sufficient. Its exsection, moreover, which would present fewer difficulties than that of the tibia, will have no occasion of being as extensive, (aussi complète.) Let a callus be once established in the solution of continuity of this last mentioned bone, and the fibula in its turn will inevitably become consolidated.

V. *Femur*.—As false joints in the femur may exist in every part of its continuity, exsection here will have to be performed after rules which must necessarily vary. This bone, however, from the great trochanter down to the knee, is to be laid bare upon its antero-external side, dividing successively the integuments, the subcutaneous fascia, the fascia lata, and the triceps muscle. The surgeon having flexed the thigh inwards and backwards, and caused the lips of the wound to be kept apart by an assistant, would have no difficulty in soon coming down upon the fractured angle of the femur; and has nothing more to do than to isolate the two fragments with his bistoury, to the extent of an inch upon each extremity,

and then to insert underneath the splint or the protecting compress, in order to put the saw into movement and terminate the excision.

§ VI.—*Containing Means.*—*Braces*, (brassarts,) and *Cuishes*, (cuissarts.)

When pseudarthroses of the humerus and fore-arm are incurable, or that the patients do not wish to have them operated upon, they may be wonderfully relieved by the use of a brace. M. Champion (*Thèse de Paris*, No. 11, 1815, p. 52) has contrived some of tent cloth (en coutil, or ticking) and small whalebone, which have been found exceedingly advantageous. Briot, (*Hist. des Progrès de la Chir. Milit.*, p. 411, 1817,) in three of his patients, found great benefit from the employment of two kinds of half-gutters, (demi-gouttières,) of iron plates, padded (garnies) on the interior, and fastened by tresses, (tresses,) which the patients arranged or tightened at pleasure. I have already remarked, that in Germany, surgeons used with advantage in such circumstances, the apparatus of the equerry, Bailly, (Rust's *Magazin*, B. XV., Heft 2; *Journ. des Progrès*, t. X., p. 257.)

False articulations of the femur have some inconveniences of a more serious character. If, however, there are some who oblige the patient to support himself, and walk with crutches, as in the cases cited by Lambert, (Lambert, *Thèse citée*, p. 38,) Lions, (*Thèse de Paris*, 1804, No. 139, p. 39,) and Sue, (Sue, *Observations*, &c., *sur quelques Maladies des Os*, p. 18, 21, 22;) there are others, who by means of a cuish, or with or without a cane, enable their patients to walk with ease, (See Vol. I.) I daily meet, says M. Seutin, (*Letter to M. Champion*, March 9, 1833,) a man with a false articulation in the upper part of the thigh who is enabled to walk by means of a very badly constructed piece of mechanism. A soldier, who had a pseudarthrosis in both bones of the leg, could hold himself erect very well, but he could not walk except by means of a very hard bootikin, (bottine.) The tailor, with a fractured femur, who could carry his foot to his shoulder, both in front and behind, and who could, according to Saltzman, (Reisseissen, *Diss. de Art. Analogis*, cap. II., § 5, 1718,) who mentions this case, use this leg for the purposes of walking and standing, as well as the other, except that he limped a little, from its being shorter, shows what great power nature has under such circumstances.

I have elsewhere spoken (See Vol. I.) of the case related by Sue, (*Reflex. sur quelques Maladies des Os*, par Sue, an XII., 1803, p. 164,) of a man, who, notwithstanding he had a false articulation of the thigh, could walk in the streets with no other aid than his cane. Meckren (*Obs. Méd. Chir.*, cap. LXXI., 1682) and Boyer (Delpech, *Dict. de Méd.*, t. III., p. 451) have also noticed the facility with which some patients are enabled to walk by means of a cuish. But sometimes the cuishes are more injurious than useful. In the case cited by Sue, the power of walking being rendered impossible,

when the two ends of the bone encountered each other, obliged the patient to lay aside the cuish, which caused this approximation.

At the upper extremity of the humerus or femur, false joints do not require an operation. The seton, cauterization, or exsection in this place, would be attended with too much difficulty or danger. Besides which, the pseudarthrosis there is not accompanied with as serious inconveniences as it is in the middle of the bones. I have met with two patients in whom fracture of the surgical neck of the humerus had not consolidated, but who were scarcely conscious of its presence.

[CASES OF UNUNITED FRACTURE, BY DR. MOTT.]

1. TWO CASES OF UNUNITED FRACTURE, SUCCESSFULLY TREATED BY SETON, by Valentine Mott, M. D., &c. (See *The Medical and Surgical Register, consisting chiefly of Cases in the New York Hospital, New York, 1820, Part II., Vol. I., p. 375-379.*)

Case 1. Stephen Hammond, aged about thirty-five years, was admitted into the hospital with lameness, in consequence of a fracture of the leg about seven months since. Upon examination, the tibia was found ununited, and to admit of very free motion between its ends. The fibula was entire, and the patient believed it had never been broken. From the account which he gave, it appeared that he had been subjected to the proper treatment for the restoration of a broken bone, but he stated that it never showed any disposition to unite, under the course which was pursued.

As his general health was not good, he was put upon tonic medicines and invigorating diet, and I directed that a stimulating plaster of gum ammoniac and mercury should be applied over the part, with the many-tailed bandage; and splints to reach above the knee and below the ankle, and to be very firmly secured; and I advised him to walk upon it, with the assistance of his crutches, as much as the pain would any way permit; informing him that the object in wishing this exercise, was to inflame and irritate the ends of the bone, and that he must not desist, even though considerable pain should accompany it. This was persevered in for several weeks, but finding little or no pain to attend it, and no appearance of inflammation in or about the fracture, and no hope of amendment, it was discontinued. Blisters were next repeatedly tried, but to no purpose. Very powerful shocks of electricity also were passed in different directions through the part, but they produced no beneficial effects.

A seton was next introduced: this I did by making a small incision upon the outside of the tibia, down to the fractured ends; then passing between the bones the stillette of a small trocar, and pushing it out on the opposite side, the seton was readily introduced with an eyed probe.

In a few days considerable inflammation and pain supervened,

which required emollient poultices and the antiphlogistic treatment to subdue. This was soon followed by a copious discharge of matter from the seton, and a collection of pus on the anterior part of the tibia, which was evacuated by a small incision. After five or six weeks, he became sensible of an increase of firmness in the leg; and from this time he was directed to diminish the size of the seton one thread every other day, until it was all removed. It continued to grow stronger every day, and in a short time after the wounds healed, he was permitted to walk a little upon it, when splinted and tightly bandaged; and in about three months, the bone was firmly united.

Case 2.—John Smith, aged forty-one years, became a patient in the hospital in 1819, in consequence of an ununited fracture of the thigh bone, of twelve months standing. It occurred at sea, and at the same time several of his ribs were fractured. Thirty-six days after the accident, he arrived at Halifax, without having had any attention paid to the adjustment of the bones. After his arrival he states, that little notice was taken of his thigh, and no attempt was made to reduce it. He recovered without difficulty from the fracture of his ribs. The several means mentioned in Case 1, were tried, but without benefit. The limb was considerably shortened, from the obliquity of the fracture and ends of the bone overlapping. No advantage attending the use of the means referred to, a seton was recommended. In the introduction of this, much more difficulty was experienced than in the case of Hammond.

An incision was made on the inside of the thigh, a little to the outer side of the artery, so as to come down upon the centre of the ends of the bones, where they overlapped. The *stilette* was then attempted to be passed between the bones, but this was found altogether impracticable, from their very close contact, even though the limb was changed from one position to another. Instruments of different sizes were resorted to, but they could only be made to pass a very small distance. A *gimlet* was tried, but very little progress could be made. Having provided for the occasion a *carpenter's bit*, about the size of large trocar, I found, with this, a passage could be made with the greatest facility. Then, by making an incision down to the end of the instrument on the outside of the thigh, a large seton was readily conveyed through between the bones, by means of a long eyed probe.

After the expiration of three months, the thigh becoming firmer, and much less motion being felt between the ends of the fracture, he was permitted gradually to lessen the size of the seton. The firmness continued regularly to increase, but it was not until after eight months had elapsed, that the thigh had acquired sufficient firmness to enable him to support the weight of his body, by the aid of a crutch.

It is now more than twelve months since the seton was introduced, and the bone appears to be firmly united. The shortening of the limb does not exceed three inches and a half.

A third case came under my care in the hospital, of an ununited os brachii, of several months' standing. A seton was readily passed between the ends of the bone by the stillette and eyed probe, but the result of it cannot be stated, as the man left the hospital a week or two after the operation was performed. From the good health of the patient, however, there is every probability that it answered the same salutary purpose as in the other cases.

2. UNUNITED FRACTURE OF THE OS BRACHII.—*A Seton Introduced without Success.—Union Effected by Sawing off the Ends of the Bones.* By Valentine Mott, M. D., &c. (See *New York Medical Journal*, New York, 1830, No. 2, Vol. I., p. 275 : being one of the Surgical Cases at the New York Hospital, drawn up by Alfred C. Post, M. D., for the months of July, August, September, and October, 1830.)

James Norton, a middle-aged man, of good constitution, admitted April 5th, 1830. Ununited fracture of the os brachii. It was broken in the middle of January. Splints were applied until the time of his admission. About the 10th of April, Dr. Mott passed a seton between the fractured ends, and Kent's apparatus for fractures of the arm was applied, by means of which the arm was kept at rest in a flexed position. Sept. 28th. No union having taken place, Dr. Mott withdrew the seton a few days ago. To-day he made an incision on the external part of the arm down to the upper portion of the bone, the extremity of which he detached from the surrounding parts; he then passed a chain saw under it, and sawed it off. The lower portion of the bone, which lay on the inside, was then laid bare with considerable difficulty, owing to its depth, and to the vicinity of important parts, and the chain saw was passed under it; but in attempting to saw it off, the saw was broken. The extremity of the bone was then partly sawed off by means of a rotatory saw, and of Hey's saw, and partly broken off with bone nippers. It was then raised up, and sawed smoothly off with a metacarpal saw. The whole length of bone removed was more than two inches. The extremities of the bone were then perforated with a drill, and united by means of well-annealed iron wire, the ends of which were passed through a double canula, and secured without. The edges of the wound were brought together with sutures and adhesive straps, and Kent's apparatus again applied. Two or three weeks after the operation, the wire came away, the arm became gradually stronger, and on the 15th of December, when he was discharged, the union was complete. He had not yet, however, regained the full use of his arm, as the muscles were very much relaxed by the shortening of the limb.

[*Cure of Ununited Fracture of the Femur, Tibia, and Os Brachii.*—In addition to the first case of successful cure of ununited fracture of the femur, by seton, Dr. Mott has since treated two others of this bone successfully by the same mode; and also has met with like

success in ununited fracture of the tibia, several times in the os brachii, and also in one of the bones of the fore-arm.

A rule which he lays down in this treatment is, that unless the ends of the bones are in actual contact, no reliance can be placed on this method; and the more the ends *ride over* each other, the more prospect is there of success.

In these last cases, where the ends of the bones lap over very much, Dr. Mott has in several instances of ununited fracture of the femur, found it necessary to drill a hole between the ends, which are found firmly united by ligamentous tissue, in order to pass the seton through the opening thus made.

In another case of the os brachii, Dr. Mott found the seton also fail, though he had kept it in several months and reintroduced it. This case also was afterwards cured by exsection of the ends of the bones. T.]

ARTICLE III.—EXSECTION FOR DEFORMED CALLUS.

With the view also of repairing (*redresser*, *i. e.*, to pare or flatten down, shape, adjust, &c.) a deformed callus, many authors have proposed or performed upon it the process of rugination (rasping) or exsection. Paul of Egina, (*Daléchamps, Chir. Franç.*, p. 467, 787, 788, 790, 791, Chap. 107, 108, 109,) who recommends, and also describes different kinds of exsections for compound fractures or deformed callus, was censured on that account by Guy de Chauliac, who, according to a quotation in Boyer (*Malad. Chir.*, t. III., p. 107,) complains that a philosopher was nearly killed by the consequences of such an operation, “because he could not content himself with remaining a cripple,” (*pour n’avoir su demeurer clopinant*;) but the question of Hevin, who asks if there ever will be found a patient courageous enough to sustain it, or a surgeon bold enough to undertake it, can now be responded to by a multitude of facts. According to M. Oesterlen (*De la Rupt. du Col*, p. 124,) after having broken the callus, he exsected with the saw to the extent of three lines from the inner and outer portion of the two pieces of the bone. The exsection of a projecting portion of the femur above the knee, after the consolidation of a vicious callus, was also performed upon the famous Ignatius Loyola, at the age of twenty-eight, (A. D. 1521.) An old surgeon, (*Hildanus, in Oesterlen, lieu cité*, p. 189,) in a case of fracture of the femur from a fire-arm, recommended the rupture and excision of the callus by means of the cutting pliers, (*tenailles*.) Albucasis, according to Oesterlen, had also advised to take off the callus with a cutting instrument when it should become hard like a stone. Gardeil, (*Traduction des Œuvres d’Hippocrates*, t. I., p. 300,) states, that he divided the bones of the fore-arm on one of his nephews at the point of an old fracture, and that he succeeded perfectly. Though in the case of a femur which had united at a right angle, Wasserfuhr, (*Rust’s Magazin für die Gesamte Heilkunde; Journal d’Hufeland*, 1816, Octobre,) only separated it with a saw, M.

Riecke, (*Bull. des Scienc. Méd., Journal Analytique*, December, 1828, p. 466 ; or *Arch. Gén. de Méd.*, t. XVIII., p. 105,) in a case where the thigh was shortened eight inches, did not hesitate to employ the saw, gouge and mallet. A perfect consolidation was established in the space of eight months. An exsection of four fingers' breadth from the body of the two bones of each fractured leg, whose consolidation had been attended with excruciating pains, was performed with success in 1685 or 1686 (*Journal de Méd.*, in continuation of that of *Laroque*, p. 58, 1686.) A young man had a callus in the femur of the size of the head, with the fragments also riding over each other. M. Weinhold, (In the *Journal d'Hufeland*, 1816, cap.V., p. 25 ; and *Journal Analytique*, No. VIII., p. 240, 1828.—*Arch. Gén. de Méd.*, t. XVII., p. 445,) by means of a trephining needle (aiguille trépan—nadel trephine,) introduced a seton between the fragments, and effected a cure without the necessity of proceeding to exsection. But the operation of exsection here evidently blends itself with what I have said of rupture of the callus in another chapter. (See Vol. I.)

In speaking of the straightening of limbs curved at an angle in consequence of fractures viciously consolidated, I neglected to speak of an operation of this kind which was performed with success by M. Warren. This operation, which in reality belongs to exsections, was performed by M. Warren on the tibia ; while M. Clemot and M. Barton had hitherto applied it only to the femur. The leg was bent at quite an acute angle ; M. Warren extracted from this boney angle a wedge-shaped fragment, then straightened the limb, and easily effected its consolidation. It is not solely with the view of rectifying a deformed limb and of giving it more or less length, that we sometimes find it necessary to excise certain portions of a vicious callus. After the cure of fractures, boney points or angles may project under the skin, and become the source of pain and of ulcerations that are difficult to heal. Exsection in such cases is not, in my opinion, sufficiently often performed. Meyranx, a physician of some distinction, broke his leg. After the consolidation the point of the lower fragment of the tibia projected under the skin in the form of a very acute elongated ridge (crête.) An ulceration which would reopen whenever he took a little more exercise than usual, together with almost constant pains, were the consequence of this infirmity. An incision of two inches' length and which would not necessarily have comprised any thing more than the integuments, would have allowed of this projecting crest to be removed with a single stroke of the saw or cutting pliers ; but the patient, who died two years after, could not bring his mind to submit to it. When we reflect upon the frequency of this deformity after oblique fractures of the leg, and the annoyance it occasions, and upon the simplicity and little danger of the operation, it is difficult to withhold our surprise, from the fact that science possesses so few examples in which its exsection has been performed.

The humerus, especially its lower part, is sometimes the seat of a

similar deformity. A woman who entered the hospital of La Charité for a comminuted fracture at three fingers' breadth above the elbow, ultimately got well; but when the wound had cicatrized and the engorgement of the soft parts had subsided, it was found, that in the consolidation which had taken place, one of the fragments projected under the skin, above the outer condyle (epicondyle) in the shape of a sharp long crest. As this ridge caused pain and interfered with the movements of the fore-arm, the patient was the first to desire its removal. I divided the integuments and aponeurosis to the extent of two inches, in a direction parallel with the axis of the humerus and upon its outer border. The lips of the wound being then held apart and pressed down, I found it easy to isolate the bony projection and to excise it with the cutting pliers. The borders of the wound approximated together in some degree of themselves, and reunion was effected by first intention.

In its application to a deformed callus, exsection of the bones is still one of those independent (magistrales) operations which cannot be restricted to any prescribed rules. In most of the cases the projection of bone to be removed will answer as our guide; in other cases the surgeon is only to recollect the point where he can most easily reach without danger the bone which he wishes to excise. It is moreover manifest that inasmuch as they do not destroy the continuity of the bone, these lateral excisions and the removal of simple ridges (rugosités) or abnormal projections of the callus, are far from involving the same dangers or constituting an operation as serious as that of exsection in cases of compound or non-consolidated fractures. When once terminated, for example, they require no other attentions than those of simple wounds. The healing up of the solutions of continuity which we are obliged to make, is generally effected with promptitude, and requires no aid from the apparatus used in fractures.

[CASE OF DEFORMED LEG, FROM UNSUCCESSFULLY TREATED FRACTURE, cured by an operation performed by JOHN RHEA BARTON, M. D., (See *Philadelphia Examiner*, Jan. 8, 1842, Vol. II., p. 16, with a plate.)

About half-past seven o'clock, P. M., on the 18th of December, 1838, while in charge of the deck of the U. S. Ship Ohio, then at sea, Lieutenant — fell from the horse block, about four feet high. The weather being cold and boisterous, he was heavily clothed in a pea jacket, &c. His foot became engaged in a coil of rigging on the deck, while the body was carried forward, and the right tibia was fractured transversely at about its lower third, and the fibula at about two and a half inches above the ankle.

A gale of wind, then commencing, lasted several days.

He was placed in his apartment on the orlop deck, where the circulation of air was very much interrupted, and probably much vitiated by the number of persons breathing it.

The limb was set by the surgeon. He suffered very much from

the motion of the ship, and in the night was attacked with severe spasms in the limb ; and he distinctly felt the fragments slip upon each other.

On the 5th of January, 1839, the ship arrived at Mahon, and on the following day, the nineteenth after the accident, the patient was moved on shore. During the transportation from the ship he suffered great pain from the moving of the ends of the broken bones on each other.

He remained in bed eight weeks, and when he got up, the limb was still flexible at the point of fracture. Getting out of bed was at first very painful, and usually occupied fifteen minutes.

When he got up he was urged to exercise the limb, and three or four weeks afterwards to bear his weight in a degree upon it.

In consequence of the accident, and its unsuccessful treatment, the upper fragment of the tibia rides the lower one, overlapping it about half an inch, forming an obtuse angle which presents inwards. The limb is shortened a half inch ; there is a concavity inwards, on the outside of the leg, as might be the case if the fibula were pressed inwards against the tibia at its lower third ; the flexor muscles are thrown out of their normal line of action, and the external condyle of the femur seems to be, in a measure, alone in the essential constitution of the knee joint, the internal ligaments being elongated, and the knee thrown inwards. (*See the Cut.*)

The patient suffers no pain ; and the only inconvenience complained of is, that his footing is not certain when at sea, and that he suffers under pain and weakness in the knee on taking unusual exercise on shore.

For the purpose of removing this inconvenience, and correcting the deformity, the patient came to Philadelphia, and after having been carefully examined at different times, and at considerable intervals, by Drs. Thomas Harris, W. E. Horner, J. Randolph, W. S. Ruschenberger, J. Rhea Barton, and Paul B. Goddard, anxiously submitted to an operation.

Lieutenant — is a native of South Carolina ; he is thirty-four years of age, about five feet eight inches high, of nervous sanguine temperament, light eyes, ruddy complexion, and, with the exception of an attack of fever on the coast of Africa, in 1824, has enjoyed uninterrupted health. He does not use tobacco in any form.

For a month he has regulated his diet with a view to the operation, eating moderately of meat once a day.

Having procured an airy, comfortable apartment, and made the



necessary preparations, he submitted to the following operation, performed by Dr. J. Rhea Barton, assisted by Drs. Norris, E. Peace, Paul B. Goddard, W. P. C. Barton, and Ruschenberger.

Oct. 18th, 1841. Weather clear and cool. Ten minutes before commencing the operation the patient swallowed thirty-five drops of laudanum. He was placed upon the table at twelve o'clock.

Two incisions, three inches in length, were made over and parallel with the internal and external margins of the tibia, three inches apart at their upper extremities, and two and a half at their termination. These two incisions were connected by a transverse cut, made a little below the nearly square projecting end of the upper fragment of the tibia; the three incisions describing the letter H. The flaps thus formed, consisting of the skin and subjacent cellular tissue only were raised up, exposing the fragments of the tibia at their point of union. The adjacent muscles were separated from the bone by the handle of the scalpel; the periosteum, very near the lower termination of the upper fragment, was divided by the scalpel; a small saw, somewhat in the form of a carving knife, about ten inches long in the blade, suddenly tapered into a point of two and a half inches long, and rounded at the extremity, was next employed, and a slice of bone, less than a line in thickness, removed from the extremity of the upper fragment. The saw was carefully worked in the same line of direction and in the same plane, frequently removing it to clear its teeth by a sponge, until the lower fragment was divided nearly through. What remained was forcibly fractured—a short, stout spiculum, adhering to the posterior portion of the lower fragment, and which was afterwards removed.

Upon examination it now was found, as was anticipated, that transverse bridges of bone connected the tibia and fibula together above and below the seat of fracture—having been formed there after the injury for the wise purpose of supporting the weakened limb—and prevented the upper and projecting portion from being brought in a normal line with the lower fragment. These bony bridges were removed by the aid of a chisel and strong nippers; and by the same means the ends of the two fragments of the tibia were adjusted and finally brought into perfect coaptation. The operation occupied nearly an hour. No vessel required ligature; and the loss of blood did not exceed eight ounces.

The edges of the wound were brought together, and retained by adhesive straps. Lint, spread with simple cerate, was placed over them. The limb from the toes to the knee was then covered by successive turns of a roller. The patient was now carefully removed to bed. A soft, square pad, two inches thick, was placed over the external malleolus, and a similar one close to the knee joint; upon these was laid a splint two and a half inches wide, to which the two fragments of the tibia were confined by a few turns of a roller applied at the proper points. A soft pillow, covered with oiled silk, was made to half encircle the limb, by the aid of splints in a splint cloth, and the whole secured by tapes. The limb

was protected from the pressure of the bed clothes in the usual way.

Directed to take in the evening a cup of weak black tea, and a piece of dry toast.

9 o'clock, P. M. Patient comparatively comfortable.

19th, 9 o'clock, A. M. Skin natural; very slight suffusion of countenance; bowels not moved, pulse 80 and soft. Had very little sleep since the operation; experienced some few "twinges" in the limb. Became comparatively easy an hour after the operation. Complains of not being able to relax the muscles of the limb. Pain in the back last night and this morning.

A compress placed over the upper fragment, near its inferior extremity, to prevent its rising; it is secured in its place by tying one of the tapes of the splints across it.

Diet.—Barley water, chicken broth.

6 o'clock, P. M. Comfortable. Felt oppressed after taking broth: relieved after passing urine and perspiring freely. Urine, brandy-colored.

20th, 9 o'clock, A. M. Pulse 76; skin comfortable; looks cheerful. At 4 o'clock, A. M., had severe continued pain in the abdomen, probably from flatus. Patient applied hot dry cloths with advantage. Tongue slightly white.

Diet.—Small piece of roast beef; barley water.

9 o'clock, P. M. Has not been able to have an evacuation from the bowels from want of convenience, as he cannot get a pan beneath him, and is insurmountably repugnant to the use of a sheet. Complains that he has passed a miserable day; belly very tender and sore, but it is soft and not distended; pulse 76. Moved to a mattress with a movable piece on the left side, corresponding to the pelvis. The moving caused great pain and considerable exhaustion.

21st, 9 o'clock, A. M. After taking some warm broth the bowels were moved; and he has had another evacuation this morning. Slept several hours. Soreness and tenderness of the abdomen have disappeared; pulse 76; comfortable; says he is not aware, from any uneasy feeling, that his leg is broken.

External soiled parts of the dressings removed by scissors, and a Scultetus bandage placed over the whole; the oiled silk changed for a clean piece.

Diet continued.

6 o'clock, P. M. Had spasm in the leg in the afternoon.

22d. Half past 9 o'clock, A. M., pulse 76, and after taking coffee, (which acts kindly on his bowels,) 79. Had very little sleep last night; some spasms; bowels open.

Removed the dressings. Wound healthy.

A number of maggots, nearly a half inch long, about the wound. Washed with Castile soap and warm water. Dressing of lint and simple cerate. Pads at the ankle and knee removed, and the splint, lightly padded, brought into contact with the limb. From a slight

thickening of the lower flap, the lower fragment of the tibia *seems* to be in advance of the upper one.

Continue diet.

6 o'clock, P. M. No sleep; some spasm; great pain in the foot from pressure of the bandages, which was relieved by removing and re-applying them. Wound looks well.

Liquor. anodyn. Hoffmani. H. S.

23d. Half past 9 o'clock, A. M. Slept about five hours last night; bowels open; pulse 76. Continue treatment.

6 o'clock, P. M. Has had a comfortable day.

24th. Half past 9 o'clock, A. M. Slept four hours; comfortable; pulse 76; bowels open; urine high colored, but now transparent. Continue treatment.

27th. Nothing remarkable since last report. Slept very little last night. Wash the wound with tinct. n. yrrh.

Continue diet; half a tumbler of Philadelphia brown stout.

28th. Slept six hours. Bran bags applied. Continue treatment.

Nov. 2d. In consequence of the upper fragment having slightly fallen out of its proper line, a straight, narrow splint was applied on the outside of the leg.

5th. Paste board splint applied to the inside of the leg; bone begins to stiffen.

6th. Splint applied on the inside of the leg, which reposes on the pillow without being secured by the splints and splint cloth. Bowels are open every morning; pulse 80; sleeps four or five hours in the twenty-four; is very cheerful.

7th. Wound nearly healed; suppuration has almost ceased.

Dec. 31st. At present the patient is walking about his apartment, aided by a cane. He wears the same boots that he wore previous to the operation, and does not think the limb is appreciably shortened. At the end of a fortnight he will be able to travel; but at this time it would be premature to state what the effect of the operation has been, although the limb is straight, and not appreciably shorter than it was prior to the operation.

To the young practitioner of surgery this case is particularly interesting, and should lead all to study carefully the treatment of fractured bones, the result of which, if successful, adds very little to the reputation of the surgeon, but, if otherwise, is calculated to injure his professional character. T.]

ARTICLE IV.—ORGANIC LESIONS.

Exsection for caries, necrosis, &c., though less frequently performed than for the cases we have just spoken of, is nevertheless very often indicated. Apart from the observations of Tenon, (*Expér. sur l'Exfol. des Os*, 3e Mém., 1758, 1759, 1760,) who had the boldness to remove in this manner the great trochanter; of Moreau, (*Thèse*, Paris, 1803,) who, in 1793, excised a considerable portion of the tibia; of Percy and Laurent (*Dict. des Sc. Méd.*, t. XLVII.) who state that for a caries, or rather without doubt for a necrosis

of the leg, they have destroyed this last bone by means of the saw, or trephine, to the extent of eight or ten inches, and removed the *entire fibula*; of Belclard (*Bull. de la Fac. de Méd.*, t. VI., p. 353) who, following the counsels of Desault, also ventured to extirpate by exsection the upper third of the fibula for a *spina ventosa*; of Hey, who relates in his work many operations of excision of the bones of the leg and arm; of M. Couty of La Pommeraye, who has published an exsection of almost the entire extent of the humerus; French classical authors scarcely make mention of this kind of operation, which was again performed a few years since with complete success at the Hospital Beaujon, for a very extensive necrosis of the tibia. The surgeon, compelled to conform himself to circumstances, and to vary the operative processes according as the limb has preserved or lost its natural forms, and according to the extent and seat of the disease, lays bare the bone by means of longitudinal incisions, or when it becomes necessary, by cutting out at the expense of the soft parts, one or more flaps of sufficient size, and of variable shape. The disease being exposed to view he now makes use of the saw or the trephine; in other cases of the gouge and mallet; the saw, when the bone is cylindrical or not very large; the trephine when it is a large bone and difficult to isolate, or when it presents a great degree of thickness, or, in fine, when the surrounding parts do not admit of the use of the saw; the chisel, (ciseau,) when he wishes to remove only a few laminæ, or a part only of the calibre (épaisseur) of the diseased bone. We may employ also the cutting pliers or any other instrument which the skilful operator will know how to devise. M. Seutin (*Soc. des Sciences Méd. et Nat. de Bruxelles*, December, 1829) who has extracted with singular success almost the entire fibula, had recourse to the trephine to separate its upper extremity and divided the other with a curved saw. It is in such cases that the flexible or chain saws are especially serviceable.

Not only may exsection be performed upon the middle of the limbs for the organic diseases described farther back; but also upon the trunk, cranium, sternum, ribs, clavicle, vertebræ, &c.

§ I.—The Cranium.

The excision of the bones of the cranium, for caries, necrosis, or degeneration, has often been performed; and it is this which has served as the point of departure for the operation known under the name of *trephining*.

The instruments we employ in such cases, are the rasp, the chisel, the gouge, M. Heine's saw, M. Martin's osteotome, and the different sorts of rowel saws and the trephine.

For superficial carious affections, whatever may be their extent, we confine ourselves to the use of the rasp. Having laid the diseased parts bare by means of the proper incisions, the surgeon, holding the cutting plate (plaque tranchante) of the rasp in his left hand, and embracing its handle with his right hand, proceeds to

scrape and grate (*gratter*) the carious or necrosed surface, until he has completely removed it, and perceives red points (*poin-tillé rouge*) and a granular aspect, and no longer a yellow or livid tint, at the bottom of the rasped surface, (*la plaque ruginée.*) With M. Champion, I cannot understand how Duverney and Rich-ter should have recommended to rasp the bones with a piece of glass, rather than with the rasp properly so called.

If the bone should be degenerated to more than a line in depth ; or if, as almost always happens, the case is one of necrosis rather than of caries, it would be difficult to come down to the seat of the mischief by means of the rasp alone ; in such cases we might have recourse to the chisel or gouge. But the strokes required upon these produce a fearful concussion, on which account surgeons usually prefer the use of the trephine instead of the instruments in question.

A resource which is sometimes preferred to all the above, when the disease has not penetrated through the thickness of the cranium, is the *red hot iron*, (*le fer rouge.*) This practice, however, is now proscribed from surgical practice in all cases wherever the cranium does not present an extreme degree of thickness. Thus no one would venture to apply the actual cautery to the frontal, parietal, or even the occipital bones. The mastoid processes alone rigidly admit of its application. The caloric which would soon be communicated thereby to the membranes or the brain, would give rise to accidents more serious than the disease itself.

M. Heine's osteotome, and M. Martin's saw, have, at the present day, put it in our power to remove a part or the whole of each one of the bones, which enter into the composition of the cranium, without the necessity of recurring to the chisel, gouge, mallet, trephine or hot iron. The first of these instruments, in fact, is arranged in such manner, that the diseased bone, after the soft parts have been detached from it, can be removed layer by layer, to any depth and to whatever extent may be desirable. That of M. Martin, for which we may, in a case of necessity, substitute Thompson's or Charrière's saw, enables to circumscribe the whole of the diseased bone, in a circular, quadrangular, triangular or rhomboidal (*lozangique*) disc, and to remove it by penetrating, or not, down to the dura mater, according as the state of the parts may require, or may allow us to dispense with doing so. With these two instruments, we may and can in fact take out the part of the bone diseased, in the same manner as we would a portion of diseased integument, in making use of the bistoury.

It must be remarked, however, that the instrument of M. Heine, so efficacious in the hands of its author, and of Jæger at Wurtzburg, required an hour and a half's manipulation to remove a necrosis from the forehead, in a patient of M. Ricord, (*Gaz. Méd. de Paris*, 1834, p. 644-648.)

It is unnecessary, after the operation, to round off the borders of the osseous division with the lenticular knife or rasp. We should restrict ourselves to the removal of the points, angles, or thin scales

of bone, if any should exist, which would seem calculated to irritate the soft parts. While approximating the flaps of the hairy scalp, I would not recommend that their edges should, in every point, be brought into exact coaptation, and I regard it as a precept of the highest importance, that we should dress such wounds from the bottom, with small balls (boulettes) of lint, for some weeks, and not endeavor to effect immediate union.

Very extensive portions of the cranium may be removed in this manner, without seriously compromising the life of the patient. Verduc, David, Soulié, and Lapeyronie, mention the cases of individuals who had lost a fourth, or third part, or the *half* of the vault of the cranium, by necrosis or the operation of the trephine, and who, notwithstanding, enjoyed good health. We must learn in the memoir of Quesnay, what we may hope for from an operation of this kind, which Roger, Guy de Chauliac, and De Vigo, among the ancients, had it would seem already formally advised, as Celsus had in fact before them, and which Percy since has taken special pains to bring into repute.

Nevertheless, I would not recommend that the exsection of the bones of the cranium should be performed without being specially indicated. Marchettis, Theden, Wurms, and Brahery, (Champion, *Traité de la Résection*, p. 28,) who profess to have employed it with success in epilepsy, have had very few imitators, notwithstanding the remarks of Odier, of Geneva, (*Manuel de Méd. Prat.*, p. 180,) and some other modern authors.

An important circumstance, and one which ought to restrain the ardor of surgeons in such cases, is, that nature herself, alone, often triumphs over caries and necrosis of the bones of the cranium. Because the bones of the cranium are denuded, and in contact with pus, or have been for a long time exposed to the action of the external air, we are not, therefore, necessarily to conclude, that we must undertake their excision. [This is a truth, as I have remarked in a note, in Vol. I., that every practitioner of experience has had occasion to verify. T.] I have elsewhere (*Traité des Plaies de Tête*, Paris, 1834) related numerous facts in confirmation of this assertion, and I could at present add to them a multitude of others. It has so often happened to me to see wounds of the head, of all sorts and of all dimensions, from cutting or blunt instruments, simple or compound fractures, ordinary causes or fire-arms, lay bare the entire surface of the bones, pass into suppuration and remain with their lips separated during the whole period of the cure, and to allow of our recognizing with the probe as well as by means of the eye or finger, the sonorousness and perfect denudation of the bone; and afterwards to observe the surface of this bone gradually recover its vital forces, and become adherent to the soft parts in the same manner as if it was a common wound, and without being attended with the least exfoliation; that I cannot too earnestly recommend to surgeons to rely greatly, in such cases, upon the efforts of nature, (à l'expectation.) I shall again recur to this subject in speaking of the trephine.

§ II.—*Bones of the Face.*

There is scarcely any other part of the face than the bones of the two jaws whose exsection has been treated of under the head of special operations. The other bones of the face, however, also present occasions for the operation of excision or exsection, when affected with caries, necrosis or degeneration, for which reason I shall commence with them.

A. *The Orbit*.—If some point alone on the contour of the orbit should be degenerated, we could remove it without interfering with the eye, and often in fact without implicating the corresponding eye-lid. The os unguis, the ascending process of the superior maxillary bone and the ethmoid, have often been removed in cases of fistula lachrymalis. I shall speak of this further on under the head of this last mentioned disease.

The *supra-orbital arch* was completely necrosed in a woman, who would have willingly submitted to its removal, had not her advanced age and the visceral derangements (lesions) under which she was laboring at the same time, deterred me from undertaking it. M. Stark (Coulon, *De la Carie des Os*, Wurtzburg, 1833, p. 23) or M. Heine however (*Gaz. Méd. de Paris*, 1834, p. 644) appear to have once performed this operation successfully. There are two different modes in which this operation may be performed; that is, either by raising up on the forehead a semi-lunar flap from the eye-lid which is to be allowed to fall in place after the operation by its own weight, or by bringing down upon the eyelid a flap of the same form from the forehead, which is afterwards to be raised up to its place. The bone being thus laid bare, should then be removed with cutting pliers or the mushroom-shaped (*en champignon*) saw of M. Martin, rather than with the osteotome of M. Heine. The gouge and the mallet might also be employed, if there should remain any angular projections to be removed. The concussion upon the cranium in this region would be too slight to make it necessary to proscribe the use of these last mentioned instruments in such cases.

The *inferior border* of the orbit being less prominent than the superior, would therefore be less easily submitted to the operation of exsection. It is, however, rare that this part is attacked with caries or necrosis, unless a portion of the maxillary or of the malar bone (*pommelte*) also participates in the degeneration. Many surgeons, among whom we may mention Jæger, MM. Dietz, (Coulon, *Opér. cit.*, p. 28,) Syme of Edinburgh, and Dieffenbach, appear to have performed this operation with success. A large sized callus of the malar bone was successfully removed by Séverin, (*Méd. Eff.*, p. 315, § 953;) Bordenave also, after having extracted several sequestra from the two portions of a carious malar bone, succeeded in effecting a cure of his patient, (*Acad. de Chir.*, t. XII., p. 53.)

B. Without speaking of the cases where the *malar bone* has been

removed conjointly with the superior maxillary and inferior border of the orbit, I will remark that the zygomatic (jugale) wall of the maxillary sinus, and the entire zygomatic arch (saillie) itself have been exsected by myself in two different cases. One of the patients had had the malar bone carious and necrosed for more than two years. Having laid bare the parts by means of a crucial incision, I removed the greater portion of the diseased bone with the mushroom-shaped saw and the rest with a few clippings of the chisel. The whole of the malar bone and almost the entire lower border of the orbit were thus extirpated, (détruits.) In the other I applied the point of a very strong pair of scissors at the fistulous opening which existed on the outside of the dental arcade, and divided the whole wall of the sinus forwards, then backwards, and finally upwards, without involving the parts of the cheek properly so called.

C. The *zygomatic arch* which was formerly removed by Loyseau, (*Observat. de Méd. et de Chir.*, 1617, p. 34,) has also been exsected by M. Heine or M. Jobert, (*Gaz. Méd.*, 1834, p. 644;) and I have met with two patients in whom it had been for so long a time in a state of necrosis, that it would have been proper to have submitted it to the same operation. We may readily understand in these cases, that the arch being laid bare by means of a transverse incision, which could be transformed into an L if the disease had extended to a great distance in front, and could afterwards be dissected above and below, and the bone removed or detached by means either of Liston's pliers, the chain saw, that of M. Martin, or even the gouge or mallet, &c.

D. Nobody appears to have more boldly or frequently performed exsections upon the bones of the face than M. Dieffenbach. In a note published by him in 1838 (*Expérience*, t. II., p. 55) he relates *eighteen* examples of these operations, which however in the first, second, third, fourth, eighth, ninth, thirteenth and eighteenth cases, relate only to the removal of the alveolar border. In the sixteenth we perceive that this surgeon, in order to remove a cancerous tumor with the greater part of the bones of the nose and orbit, was obliged to dissect up in the manner of a mask all the soft parts of the face. In the twelfth he had to remove also a great portion of the malar bone. His ninth case had to lose thus almost the entire vault of his palate. But these are kinds of exsection for which every surgeon who undertakes them must devise and arrange his own operation.

E. All the exsections of the bones of the face have this peculiarity which distinguishes them from exsections of the cranium; namely, that if the nature or extent of the disease seems to require it, we may associate with them cauterization with the red hot iron, and perform them either by means of the chisel, gouge, trephine or different kinds of saws. If the solutions of continuity are not too much complicated with contusions or lacerations, we may then also make trial of immediate reunion. In some cases in fact we shut up the wounds immediately by the aid of anaplastic means. We should be wrong, however, to rely too much on these last mentioned resources, (précautions.) To however little extent suppu-

ration may seem necessary or inevitable, it is much better to dress the wounds flat, or at least to preserve an opening for them at their depending parts, rather than bring them together into too close coaptation.

ARTICLE V.—LOWER JAW.

Wounds from fire-arms, accompanied with comminuted fractures, have long since proved that considerable portions of the lower jaw may be destroyed without causing death.

§ I.—Indications.

Caries or necrosis of this bone also have frequently necessitated its destruction, and yet the persons who have been thus affected have usually been re-established in health, without even having any great degree of deformity result from the loss. Hippocrates had already furnished an example of this kind. Rhazès (*Lib. XXVIII.*, p. 329; *id.*, 1509) relates another case with all the details that could be desired; and Mesue (*De Ægritudinibus Oris*, in fol., c. 3, *De Vulnerib. et Ulcerib. Gengiv.*) also gives the case of a partial exsection of a carious inferior maxillary. F. Plater (Bonet, *Corps de Méd.*, t. III., p. 148) mentions the case of a young girl who had a part of her jaw carried away by a projectile, and could yet eat (*mâcher*) with the remainder; Boyer (*Bibl. de Planque*, t. IV., p. 656, in 4to) relates the case of a patient who recovered after having the jaw destroyed by the wheel of a mill; Runge (*Coll. de Haller*, trad., t. I., p. 146, Obs. 7) says his father cut out a part of the lower jaw for a sarcoma, whose roots were implanted in the bone; Faudacq (*Tr. des Pl. par Armes-à-feu*, p. 226, 1746) speaks of a jaw carried away by a ball, and which was partially reproduced, and Manne (*Mal. des Os*, p. 159) says the same of the chin. A woman had a tumor in the right cheek; J. Burlin, (*Coll. Acad.*, t. VII., p. 500,) being consulted, found a caries at the base of the jaw near the ear, and removed it by a proper operation; a callus which became changed into cartilage, admitted of the functions of the jaw being restored to the same condition they were in before. Gooch (*Gazette Salut.*, No. 28, p. 2, Col. 2., 1775) excised to the extent of an inch from a carious lower jaw, and Mosque (*Journ. Méd.*, t. LXXI., p. 507, No. 10) effected a cure of a cavernous exostosis of the lower jaw. If the individual who lost half his jaw by necrosis, found it impossible to perform mastication, the other patient whom Schmucker (Rougemont, *Chirurgie du Nord*, t. I., p. 192) speaks of, and who had his jaw carried away entire by a cannon ball, was completely restored. One of the most remarkable cases is that mentioned by Guernery (*Mém. de l'Acad. de Chir.*, t. V., p. 164, 1819) at Bicêtre; the lower jaw exfoliated entire, and was reproduced to such extent as to perform mastication! V. Wy (*Journ. de Desault*, t. II., p. 48) speaks of a patient who lost almost the entire lower jaw either from spontaneous causes or by

art. Two similar cases are related in the Journal of Desault, (*Ibid.*, ou t. I., p. 107, et t. II., p. 179.) Chopart and Louis have also made exsections upon the lower jaw, [*en fait l'extraction*, not meaning, of course, the *totality* of the jaw. T.] with success, (Chopart, *De Necrosi Ossium*, 1776.) In a negro, says Walker, (*Acad. Royale de Chir.*, t. V., p. 246,) in whom it became necessary to remove the two branches, and a part of the body of the jaw, mastication was ultimately re-established. A woman who Rayger (*Ibid.*) saw at Bourges, had lost the right half of her jaw. Wepfer speaks of a patient upon whom amputation of one side of the jaw had been successfully performed in his time. The patient that Belmain (*Acad. de Chir.*, t. V., p. 245) speaks of, had lost *two-thirds* of the jaw. Finally, M. Larrey (*Clin. Chir.*, t. II.) mentions the case of a soldier, who had had the jaw almost entirely destroyed by a discharge of fire-arms, and who is still living. Even at the present day we may still see at the Invalides many individuals who still carry the traces of similar mutilations.

Nevertheless, facts of this kind had remained without application, until Dupuytren, (*Leçons Orales*, t. IV.,) in 1812, came to the determination to amputate *almost the entire body of a cancerous lower jaw*, by a method entirely (*véritablement*) *new*, and which has been received into practice under the title of a surgical conquest. Since then, this operation has been repeated a great number of times by the same surgeon, afterwards in Germany, England, America and France, by MM. Mott, Richerand, Lallemand, Delpech, Roux, Cusack, Martin, Gerdy, Magendie, Cloquet, Wardrop, Lisfranc, Warren, Gensoul, Graefe, Walther, Wagner, Randolph, and myself. [See the Table below. See also Dr. Mott's CASES OF EXSECTIONS OF THE JAWS, in the General Remarks on *Exsections*, near the end of this volume. T.]

It is not for necrosis only that the operation is performed, but also and especially for cancers, and all those organic affections which, in the jaw as everywhere else, can only be cured by the extirpation of the parts which are the seat of them. Though it might have seemed difficult to have relied upon any prospect of success if the exsection was extended beyond the first molar teeth, seeing that in that case the attachments of the genio-glossus, genio-hyoideus, mylo-hyoideus and digastric muscles being destroyed, the tongue acted upon by the glosso-pharyngeal muscles, would necessarily be drawn backwards, and close up the pharynx so as to cause suffocation, yet has experience only partially confirmed these apprehensions. Dupuytren went beyond the first molar teeth; in M. Richerand's case, the whole body of the bone was removed. I have in two cases exsected this bone up to the canine teeth. After the dressing, no precaution was taken to fix the tongue in front, yet no unpleasant consequences resulted from it in this respect. M. Walther [it is said, in fact, the *totality*, (*Arch. Gén. de Méd.*, t. II., p. 466,) but I do not know what proof there is of it] and M. Graefe according to M. Pattison, and afterwards M. McClellan, have removed almost the entire jaw, and yet their patients recovered. If the disease is situated on the

right rather than on the left, or on the left rather than the right, it is practicable to leave intact the opposite half of this bone, and to remove only the side which is affected, as has been done by MM. Mott, Cloquet, Jäger, Blanchet, Ronx, &c.; in such cases, we can have no apprehensions about the inconvenience which has been mentioned. And it is still less to be feared where we can remove the whole of the disease, and still preserve one of the borders of the jaw.

It is certain, however, in other cases on the contrary, that the tongue is drawn with great force backwards and upwards as soon as its anterior attachments are divided. Dupuytren always warned his pupils of this; and Delpech, who has made it the subject of some interesting remarks, imagined that it might be prevented by passing a thread of gold or one of the sutures of the wound through the tongue near its frænum, at the moment of dressing, and fixing it to the teeth which were situated nearest to the extremity of the fragment of bone preserved. Perhaps there might occur here another thing besides retraction. The os hyoides and the base of the tongue suspended to the chin, furnish to the larynx and œsophagus every facility of dilatation for the passage of the air and aliments. But having no longer now any attachments in front they yield completely to the action of the other muscles, as well as to the *pressure of atmospheric air*, and leave the pharynx to *collapse* (*s'applatir*) from before backwards, and the posterior fauces (*l'arrière-bouche*) to close up from below upwards without there being any means of re-establishing the equilibrium. This explains why M. Lallemand was obliged to perform tracheotomy in one of his patients, and how those of MM. Ehrmann, Schuster and Bégin were attacked with asphyxia.

§ II.—*The Operative Process.*

Four modes of performing the exsection of the lower jaw are now received into practice: 1. exsection of the middle portion; 2, exsection of one side; 3, exsection of the lower border; and 4, exsection of the superior border.

A. *The Body of the Jaw.*—When the disease involves the chin only, the operation is generally easy and very simple. There are two modes of performing it. If all the soft parts are sound we restrict ourselves to their division on the median line from above downwards from the free border of the lip to the thyroid cartilage, and then to dissecting off, while reversing them outwards, the two flaps thus formed by this first incision. In the contrary case two incisions united upon the larynx in front should be made to circumscribe a V or a triangle which would include the whole of the disease.

I. The *dressings*, as in hare lip, are composed of needles, threads, a chafing dish filled with coals, and cauteries and all other objects necessary to the more delicate kind of amputations and dissections. Three assistants at least are also required.

II. *First Stage*.—The patient is placed upon a chair or upon a bed slightly elevated. If the objection to the sitting posture be that it exposes the patient to syncope, the horizontal might lead to suffocation from the blood. The assistant placed behind, with one hand, turns the head slightly backward, and with the other seizes the angle or right side of the lower lip at the moment the surgeon is about to commence the incision. The latter grasps with the two first fingers of the left hand the free border of the same lip in the opposite direction; then makes, with a convex or straight bistoury in his right hand, the proper incisions; seizes successively the two sides of the wound and detaches them to a sufficient extent from the seat of the disease, taking care to commence on the right side. This being done, he detaches the muscles and other soft parts which adhere to the borders and inner surface of the bone, endeavoring meanwhile to avoid the insertion of the genio-glossus muscle. M. Ulrich is in an error in advising that we should here detach the parts down to the periosteum, for if that were even possible, we should in this manner favor necrosis in the fragments of bone to be preserved. Having isolated the bone on each side without touching the muscular attachments at its middle portion, Delpech glided a gorget underneath to protect the tongue during the action of the saw.

III. *Second Stage*.—We might, also, as some practitioners advise, and as I myself prefer, reserve the last mentioned stage of the operation for the conclusion, and saw through the jaw before thus dissecting off the tissues. A handle-saw, or one of the ordinary kind even, if necessary, or the articulated saw if we prefer, will execute this part of our purpose. A tooth on each side of the confines of the disease should be extracted, if they have not already fallen out, or threaten to be in the way of the action of the saw. The operator, holding in one hand the anterior portion of the diseased mass, applies his thumb a little behind it and upon a sound portion of the bone, held firmly also near its angle by an assistant, in order that he may direct the action of the saw, which should, as nearly as possible, strike between two of the alveoli, and be moved from above downwards, or from below upwards, according as may be most convenient. This first division being completed, an assistant seizes with his hand the diseased tissues. That of the surgeon is now placed behind. A second movement (trait) of the saw finishes the section of the bone, which is to be depressed, in order to make it project out in front, while other assistants separate, draw back and carefully protect the soft parts of the face and neck.

IV. *Third Stage*.—There now remains nothing more to be done but to detach the diseased fragment from the tissues which occupy the interior of the mouth, by directing the bistoury flat-wise and perpendicularly upon the posterior surface of the chin. At the same moment an assistant, having a piece of linen around his hand, seizes the tongue by its point, and drawing it outwards, thus prevents the symptoms of suffocation, and enables the surgeon to apply a cautery heated to white heat over the whole extent of the

bottom of the wound, or every where at least where any arterial branch can be found.

V. *Fourth Stage*.—By means of two or three points of the twisted suture we unite the two lips of the solution of continuity, the inferior-angle of which should be left open or have inserted into it a *mèche*, (See Vol. I.) in order to give free exit to the suppuration which ensues. Adhesive plasters, plumasseaux, compresses and a sling bandage (See Vol. I.) complete the dressing; sometimes we add also some small balls of coarse lint, placed behind the tissues of the face in order to fill up the void left between the fragments of bone. M. Gensoul, apprehending that the cicatrix by being placed on the median line might, after the cure, by its retractility, flatten the chin too much, proposes to place it upon one side; but this precaution would be of no use and would not prevent the accident which suggested it.

If the tissues in front of the bone were all sound, we would be enabled, by raising up a large semilunar flap from the supra-hyoidean region, to the mouth, as M. Roux has done, (*Jour. Hebd.*, t. VII., p. 806,) to avoid implicating the continuity of the lip, and without thereby rendering the operation more difficult.

VI.—When the loss of substance is not considerable, it is well to replace the fragments of the bone in contact, and as Delpech has done, keep them immovable by fastening a metallic thread around the anterior teeth. In the contrary case, this precaution would, to say the least, be useless. The species of noose through the inferior surface of the tongue, recommended by the Professor of Montpellier, could only be advantageous, where this organ should continue to be violently retracted towards the throat. Some persons consider the bandage superfluous, and confine themselves to the suture and adhesive plasters, which gives more liberty to the parts, and enables the surgeon to examine better every step of the reparative process, (*travail pathologique*.) But all this must be contingent, and left to the pleasure of the surgeon.

VII. The *sub-mental* artery, the *sub-lingual*, very rarely the *ra-nina*, and the branch which terminates the *inferior maxillary*, together with the *coronary artery of the lips*, are the only ones which the instrument encounters, that require some attention. Some of the first mentioned are too difficult to come at in the midst of the tissues, to attempt to apply the ligature to these. Possibly the application of cold water, and sponges wet with vinegar, might enable us to control the hemorrhage they give rise to, and allow us to dispense with the use of the hot iron. Nevertheless, as Dupuytren constantly made use of this resource with success, prudence, at least, if not necessity, justifies its employment. The three last mentioned arteries cease to bleed spontaneously, and scarcely ever require our interposition. In one case M. Graefe met with a hemorrhage from the dental artery in the centre of the bone. In such cases a peg of wood or wax, as was used by M. Magendie, or any compressor whatever upon the point, from which the blood appeared to escape, might be made use of, if we did not wish to have

recourse to the actual canterly. Finally, instead of a vertical incision, or two incisions united at their lower extremity, it may become necessary, should the disease have extended to a great distance towards the neighborhood of the angles of the jaw, to divide transversely each lip of the wound below the inferior border of the jaw. In a patient, who had the chin shattered by a discharge of a pistol ball, and in whom it became necessary to exsect the jaw, as far back as the molar teeth, I was obliged to dissect to great extent the two flaps of soft parts on each side, in order to enable me afterwards to unite without any effort the two lips of the wound.

B. *One of the halves of the Jaw.*—When the amputation is to comprise only one of the sides of the jaw, the operation is somewhat different from the one we have just described.

I. M. J. Cloquet began with the vertical incision, which has been described above; then made a second, which extended from the commissure of the lips to above and behind the angle of the jaw; and dissected, as he reversed outwards and downwards, the very large flaps of soft parts thus traced out; then detached the tongue from the inner surface of the alveolar border, and terminated by the section of the bone first in front and then behind at the origin of its ascending portion.

II. *The Author.*—Operating on an old man for a sarcoma, I began with a horizontal incision, extending from the left labial commissure to the summit (sommets) of the corresponding mastoid process, and which I transformed into a T incision by means of a vertical one carried down to the great horn of the os hyoides. I had thus two triangular flaps, which I dissected, and turned back, the one in front and the other behind. After having sawed through the bone near the symphysis, I proceeded to detach from it the soft parts behind and underneath. Having raised up the angle of the jaw, and isolated the ramus, (la branche,) I cut through the neck of its condyle with the flat rowel of M. Martin, (j'en coupai le col du condyle avec la molette plane de M. Martin.) The fragment could then be separated on the inside, and depressed, and removed with the sarcoma, which, moreover, extended under the tongue, and to near the pharynx.

III. *M. Mott* proceeded in a manner somewhat different. He began with a ligature upon the carotid artery upon the diseased side, and only afterwards proceeded to the amputation of the jaw. His first incision was made to extend from a point in front of the ear, on a line with the condyle, (obliquely downwards and forwards,) so as to form a semilunar line with its convexity backwards, (and then brought still further forward, and finally upwards,) to a point above the chin, under the labial commissure.* The integuments, the lower part of the masseter muscle, and the parotid gland were

* We have interpolated this passage a little to make it more full and clear. As a good model of Dr. Mott's process in this operation, as first proposed by him, see the case in his letter to M. Velpeau, Preface of Vol. I. of this edition. It will be seen that even in the greater exsections, Dr. Mott now makes but one incision; that for tying the carotid being a small incision, altogether separate and distinct, and forming in fact a preliminary operation in itself. T.

then reversed upwards and forwards. A second incision, beginning at the upper extremity of the first, and passing below the ear, and reaching to the anterior border of the sterno-mastoid muscle, enabled to lay bare the whole extent of the diseased mass. By means of a small saw, he was enabled to divide the jaw in front on a line with one of the lateral incisor teeth. With another saw, which was smaller and made expressly for the purpose, M. Mott effected the section of the ramus of the jaw immediately below its two superior processes, and finally did not terminate with the removal of the whole diseased mass, until after having carefully detached from it the internal pterygoid and mylo-hyoid muscles. In this last stage, he advises that we should make a complete division of the inferior maxillary nerve before making any traction on the bone, also that we should not forget that the lingual nerve of the fifth pair is in the neighborhood.

Upon the supposition that it may be necessary to disarticulate the bone, which M. Palmi appears to have been the first to perform, viz., in the year 1820, and which operation has since been performed by MM. Graefe, Mott, Dzondi, Withnsen, McClellan, Liston, Langenbeck, Syme, Dupuytren, Cusack, Jæger, Anderson, Gensoul, Warren, Lisfranc, Fricke, Lallemand, and Helling; the process of M. Mott would answer full as well as for the exsection which we have just described. That which I have employed would still better fulfil the indication in such cases. A third incision, brought down from in front of the ear to the mastoid extremity of the first incision, would easily enable us to reach the articulation, without making it necessary to tie the carotid artery previously. It is, however, evident that, in these cases, the nature and extent of the evil must at every moment modify the particular rules of the operative process; so that every surgeon is in some sort the inventor of his own process at the moment of the operation.

IV. *Process of M. Graefe.*—M. Graefe, (*Graefe's C. F. Bericht über das Clinische, Chirurgische und Behre*, in Rust's *Magazin*,) who, like M. Mott, first tied the left carotid, then made an incision from the commissure of the mouth to the posterior border of the lower jaw; a second incision, of a crescent shape and terminating in the two extremities of the first, included a portion of the diseased skin; a third incision, prolonged from the posterior angle of the two first, and approaching the meatus auditorius externus, was extended upwards to beyond the condyle. The maxillary bone, laid bare by dissection, sawed upon the median line, and then detached on the inside from the surrounding tissues, was now disarticulated. The sutures were then inserted, and a speedy cure followed; nothing remained on the cheek but an opening of two fingers' breadth, through which the tongue could be seen, and from which the saliva occasionally oozed. M. Rust, who saw the young girl seven years after, dragging out a miserable existence, said that no one would be tempted, after such an example, to repeat the same operation; in that he was deceived.

V. *Process of M. Cusack, attributed to M. Lisfranc.*—M. Cusack,

who performed this operation at Dublin four times in 1825, proceeded thus :—

The *first case*, 13th of May, 1825, was one of osteo-sarcoma. The totality of the jaw was tumefied, and all the teeth on the left side loose, (tremblantes ;) the angle and ramus of the maxillary seemed both affected at the same time. The patient was seated on a chair, with his head turned to the right. A *first* incision was brought down from the labial commissure to the base of the jaw ; a *second* extended from the zygomatic arch to the angle of the bone ; a *third*, extending upwards and outwards from the inferior extremity of the first, united it to the second. The masseter being raised up, it was ascertained that the disarticulation alone would be sufficient, as the coronoid process, separated from the rest of the bone, had been previously removed. The disarticulation was effected upon the outer side of the bone, there were no vessels divided, and the patient got well.

Second case, June 3d, 1825.—The tumor extended from the neighborhood of the articulation to the small molar tooth on the opposite side. It was of very large size, and occupied the whole of the sub-lingual space. The bone was first sawed through, near the small molar tooth on the left side, with the chain-saw. The incisions were made as in the preceding case ; but M. Cusack could not immediately accomplish the disarticulation. He made another section of the bone, and disarticulated the remainder. Five or six arteries were tied, and the operation lasted fifty-five minutes. The patient recovered, and scarcely any deformity was perceptible.

Third case, October 7th, 1825.—The degeneration occupied the whole right side of the bone, and formed a mass much more voluminous than in the preceding case. The bone had undergone a solution of continuity, and the general health was greatly impaired. A *first* incision extended from the commissure to the anterior side of an opening which existed on the cheek. A *second* incision, which was vertical, sat out from the termination (de l'extrémité) of the first. A *third*, parallel with the line of the symphysis, circumscribed a flap which, adherent on its lower part, was now dissected off. The tumor was now exposed, with its ragged (lacinié) and fungous aspect. The surgeon divided the bone at a point where a tooth had been extracted. The opening of the tumor was then circumscribed by two incisions, which united together behind and above. At this point of union there terminated another incision, which had been made in a line parallel with the direction of the glenoid cavity. After the dissection, the maxillary bone transformed into a cancerous mass, intersected by numerous fissures, was removed by piecemeal. The hemorrhage was not abundant, and the cure was promptly completed.

VI. *M. Anderson* first sawed through the bone on a line with the angle of the mouth. Having perceived that the medullary membrane was diseased, he determined to proceed to the disarticulation. He divided the cheek from the commissure to the masseter, detaching this last from the bone. Raising up the tissues, he found

great difficulty in separating the coronoid process from the temporal muscle, (crotaphite.) During the tractions, the bone broke, which enabled him with ease to separate it from the deep-seated tissues, and to remove the fragments by means of the forceps and scalpel. There were only two arteries to tie. The wound was united as in hare-lip, but the patient died at the expiration of thirteen days. An effusion was found in the chest.

C. *Appreciation.*—Whenever we amputate, instead of the chin, one of the halves of the lower jaw, the facial artery must necessarily be divided. In the operation of M. J. Cloquet, it was divided at the moment of making the transverse incision, and then again in turning back the flap; but in the last step of the operation, it could, if necessary, have been avoided. In proceeding like M. Mott, we inevitably divide it on its passage upon the external surface of the bone. When the disease does not extend beyond the angle of the jaw, it is evident that the process of the French surgeon claims the preference. But when, on the contrary, the degeneration has extended very high up towards the temporo-maxillary articulation, we are more certain, by imitating the American professor, of laying bare the whole disease, while we at the same time save the parotid gland and its duct. His process would apply equally well to disarticulation, if it should be preferred or become necessary. In operating after the manner of M. Cusack, or in following my process, we are placed still more at our ease.

The *previous ligature* upon the carotid, as practised by MM. Palmi, Mott, Cusack, Walther, Graefe, Gensoul, and Warren, can become indispensable only in a very small number of cases: as, for example, where the saw is to act transversely, and very near the temporo-maxillary articulation; even then we can most usually dispense with it. The temporal artery, (which was once divided in England,) the internal maxillary, the external carotid, and the inferior dental, which run along by the side of or turn round the posterior border and neck of the condyle, where they are found upon the inside of the ramus of the maxillary bone, could easily be held aside by an intelligent assistant, at the moment when, after having made the section of the jaw in front, the operator should wish to disarticulate it behind, and detach it from the tissues which adhere to its inner surface.

The ligature applied to them separately afterwards, would be a last resource that would protect us from every danger, and the compression (*la compression*) of the primitive carotid is a thing so easy that we have no occasion to disturb ourselves on that subject. [It is probable the author means here by *la compression* of the primitive carotid, a *ligature* upon it; if he means to rely upon pressure made on the carotid tubercle of Chassaignac, it could not be effected without difficulty or danger. T.]

After having filled up the space which separates the two ends of the bone with lint, agaric, or pieces of sponge, we must unite its borders by means of a sufficient number of needles and twisted sutures, in the same way as after a simple amputation of the chin.

D. *Consequences.* At the first announcement of this operation, it was thought that there would result from it a very great degree of deformity, and an impossibility of performing mastication: nothing of this kind has happened. In *Lissier*, the first patient operated upon by Dupuytren, almost the entire body of the bone was removed, (*presque tout le corps de l'os fut emporté.*) Nevertheless it is at the present day scarcely perceptible. It is the same with almost all the other persons operated upon who have survived, not excepting even that of M. Ehrmann. Cellulous granulations soon develop themselves between the fragments of the bone, and are not long in establishing there a sort of fibrous or cartilaginous mass, which ultimately acquires a degree of solidity almost equal to that of the jaw which it replaces, and between whose two halves it forms a solid union.

It is, however, to be remarked that the patient of M. Lallemand was not so fortunate. In him the two ends of the bone remained movable, so that he is obliged to wear an artificial chin. But the loss of substance had been considerable. The wound may rest fistulous at its inferior angle, as in the patient of M. Graefe, and in this manner by the discharge of saliva exhaust the strength of the patient. One of those I operated upon was in that situation when an erysipelas carried him off on the twenty-second day of the amputation. In a patient operated upon by M. Richerand, I have seen the tongue remain drawn back in the mouth and prevent the admission of the food. Death ensued on the twenty-eighth day, and appeared to be produced by suffocation. Perhaps the same result took place in the woman operated upon by M. Magendie at the Salpêtrière in 1830, and who suddenly perished in the night.

After the ablation of one of the lateral portions of the jaw, the fixed point of the genio-glossi muscles having been preserved, there is less danger to be apprehended of retraction of the tongue. But then a deviation of the prominence of the chin, (*la saillie mentale*) sometimes quite marked, is almost inevitable. This is what took place in the patient operated upon at the hospital of Perfectionnement in 1826, and what was remarked also in the cases related by MM. Mott, Gensoul, Lisfranc, &c.

E. *Amputation of the jaw*, however, is a fortunate acquisition for modern surgery. The dentist Koecker, who has asked the question if it is ever indispensable, would not have the right to censure it in so formal a manner except he had a good remedy for cancer. Incomplete as it is, the following table shows what we have to hope or fear at present from such an operation:—

Dupuytren, 18 cases—15 cures, 3 deaths.	} <i>Leçons Orales</i> , etc., t. IV. <i>New York Med. and Phys. Jour.</i> Vol. I. and II., p. 401, and Private Communication. Observed by me in 1821.
Mott, 9 cases—2 disarticulations, 3 deaths.	
Richerand, 2 cases—2 deaths.	

- Delpech, 2 cases. { *Mem. des Hôp. du Midi*, t. I., p. 615. *Bull. de Férussac*, t. XII., p. 320.
- Lallemand, 2 cases—1 disarticulated, cancer cured. { *Arch. Gén. de Méd.*, t. I., p. 123. Lafosse, *Clinique*, *St.-Eloy*, p. 18.
- Roux, 5 cases—2 cancer, 1 necrosis. { *Lanc. Fr.*, t. II., p. 320, *Journ. Hebd.*, t. VII., p. 306; and Private Communication.
- Cloquet—necrosis, sarcoma, f. g. { Published by me, *Arch. Gén.*, 1827.
- Gerdy, 3 cases sarcoma—2 deaths, 1 cured. { *Arch. Gén.*, 2e sér., t. IX., p. 58, Sept., 1835.
- Gensoul, 2 cases—1 cured, ligature of carotid: Disarticulation; 1 death. { *Lettre Chir.*, p. 57, 1833.
- Martins, 1 cure. { *Journ. Hebd. Univ.*, 1835, t. XII., p. 229.
- Goyrand, 1 cure. { *Ibid.*
- Magendie, 1 case—1 death. { *Journ. de Physiologie.*
- Cusack, 8 cases—4 disarticulations—3 cures, 1 death. { *Thèse de Kock*, Jæger. *Journ. des Progrès*, t. VI., p. 273.
- Wardrop, 1 case. { *The Lancet*, April, 1827.
- Warren, 2 disarticulations—1 excision, 1 cure. { *Journ. des Progrès*, t. X., p. 256.
- Graefe, 5 disarticulations—the woman cured. { *Rust's Magazine*, etc., *Thèse de Kock*.
- Lisfranc, 7 cases—4 deaths, 1 cure, 2 disarticulations. { *Pauly, Bulletin Clin.*, t. I., p. 463; t. II., p. 11, 18, 73, 201. *Gaz. Méd.*, Sept., 1838.
- Walther, 1 death. { *Jour. de Graefe and Walther.*
- Wagner, 1, half the jaw. { *New York Med. and Phys. Jour.*, Vol. V.
- McClellan, 2 cases—1 cure, 1 death. { *Pattison, Burns' Anatomy*, p. 499.
- Randolph, 1—necrosis—right half of the jaw. { *Jour. des Prog.*, 2e sér., t. III., p. 268. *Medical and Surg. Jour.*, Nov., 1829.
- Beauchêne, 1—cancer—return of the disease. { *Piédagnel, Thèse*; *Jour. Hebd. Univ.*, t. II., p. 43.
- Bégin, 1 case—cancer—death. { *Reverdit, Thèse No. 85*, Paris, 1837.
- Gambini, 1—necrosis—cured. { *Bull. de Fér.*, t. XVI., p. 90. *Arch.*, t. XV., p. 273.
- Scoutetten, 1—cancer—cured. (?) { *Reverdit, Thèse*, 1837, No. 85.
- Fricke—cancer, disarticulation—cure. { *Gaz. Méd.*, 1837, p. 13.
- Regnoli, 1—cancer—cured. { *Jour. des Conn. Méd.-Chir.*, t. II., p. 330.

- Ulrich, 1 cure. *Bull. de Fér.*, t. IV., p. 100.
- Clot, 2 cases cured—left half. *Jour. Hebd.*, 1835, t. II., p. 293.
- cancer cured. *Compte-Rendu*, 1832, p. 50.
- Duverney—necrosis—cured. *Mal. des Os*, t. I., p. 198.
- Velpeau, 7 cases—4 deaths.—1829, 1831, 1837.
- Hetling, 1—osteo-sarcoma, disarticulation—cured. } *Encyclog. Méd.*, 1836, p. 104.
- Monod, 1 death. } Communicated by the Author.
- Earle, 1—spina-ventosa—cured. *Encyclog. Méd.*, p. 47.
- Anderson, 2—disarticulation—death. } *Thèse de Kock*.
- another cured. *Gaz. Méd.*, 1833, p. 383.
- Textor, 2; caries. Coulon, *Thèse*, p. 28.
- Jæger, 5 disarticulations—1 death. } *Thèse de Kock*, Jæger. Heine, *Gaz. Méd.*, 1834, p. 644.
- Dzondi, id. 1 death. } Coulon, *Thèse*, p. 28.
- Ricord, 2 cases. *Thèse de Kock*.
- Palmi, 1—disarticulation, death. *Gaz. Méd.*, 1833, p. 647.
- Michon, 1 death. *Thèse de Kock*, 1831.
- Syme, 1. Communicated by the Author.
- Convers, 1—necrosis—cured. *Opér. cit.*
- Granger, 1—sarcoma—a woman—cured. } *Gaz. Méd. de Paris*, 1835, p. 45.
- Lherminier, 1—sarcoma—death. } *Ibid.*, 1835, p. 413.
- Blandin, 1—cured. } Communicated by the Author, 1836.
- Percy, 1. *Gaz. Méd.*, 1837, p. 671.
- Blanchet, 1—necrosis—cured. } *Acad. Roy. de Méd.*, t. II.
- Langenbeck, 3 cases—2 cured, 1 death. } *Nouv. Bibl. Méd.*, 1828, t. II., p. 180.
- Kuhl, 1 death. } Coulon, *Thèse*, p. 28.
- Withusen, 3 cases—1 death. } *Encyclogr. Méd.*, 1833, p. 233.
- Perry, 1—necrosis—woman aged twenty years—extracted, regeneration, cure. } Communicated by the Author.
- A. Robert, 1—cancer—death. *Bull. de l'Acad. Roy. de Méd.*, t. III., p. 42.
- Bouyer de Saintes, 2 cases—successful (?). } *Edinb. Med. and Surg. Journ.*, Vol. CXXXVII., p. 382.
- Syme, 2 new cases—1 left side, 1 middle—cured. } *Textor, Neuer Chiron.*, Vol. II., p. 358.
- Fischer, 1—from fire arms. } *Lancette Franç.*, 15 Sept., 1836.
- Baudens, 1. } *Jour. de Graefe and Walther*, Vol. IX., p. 598.
- Mursinna, 1. } *Ann. Univ. di Med. d' Omodei*, Vol. LXXXVI., p. 39.
- Cappelletti, 1 woman pregnant—was two-thirds cured. } *Arch. Méd.*, de Strasbourg, No. 5.
- Ehrmann, 1—death—asphyxia.

Schuster, 1—death—asphyxia. ?	{ Rack, <i>Thèse</i> , Strasbourg, 9th of July, 1838.
Liston, 2 osteo-sarcomas.	Jæger, <i>Opér. Résect.</i> , 1832.
1810—Deaderick—1 cure, exostosis.	{
1817-18—A. Cooper—2 cures, exostosis.	
1818-24—Crampton—2 cures, osteo-sarcoma.	
1823—Klein—2 cures, osteo-sarcoma.	
1824—Dybeck—1 return. (?)	
1824—Eckstrum—1 death, osteo-sarcoma,	
1825—Lizars—1 cure, osteo-sarcoma.	
1827—Hodgson—1 return (?) osteo-sarcoma.	
1827—M. Awt—1 cure, osteo-sarcoma.	
1827—Arendt—1 cure, osteo-sarcoma.	
1828—Wilhelm—2 cures, caries.	{ Jæger, <i>Opér. Résect.</i> , etc., p. 1, 2, 14, 15, 16.
1831—Dietz—2 cases, 1 fungus cured.	

Out of about 160 cases, there are nearly 40 deaths. Amputation of one of the sides of the jaw, though it should extend to the articulation, promises also to be an equally valuable resource in a good number of cases. It is, however, difficult to conceive that its total ablation would be actually followed by success, and permit the patient to be restored and preserve the faculty of swallowing. We can imagine that after its exfoliation, new examples of which have been related by MM. Snell and Gambini, matters might pass otherwise. The necrosed sequestrum does not separate until the system has more or less completely supplied its absence, by the creation of a new tissue, so as to render the deformity much less perceptible. We can appreciate also that the forced extraction of the sequestrum, again performed (*encore pratiquée*) in 1830, by Dupuytren, is far from being subjected to the same operation as amputation properly so called, and that on this subject there can be no fixed process.

§ IV.—*Anterior Surface of the Bone.*

If the bone should only be superficially affected, we might, as Delpech advises, and ought, in fact, not to remove its whole thickness. Should it be a necrosis, we then lay bare the part by one of the processes described farther back; then, after having applied the handsaw or the concave rowel-saw from above downwards, to extract (*abattre*) the third or the half, or in fact the entire table of the bone, and to remove every portion that is diseased, we reunite the

borders of the wound by means of the suture. In cases of sarcoma, the portions of the lip and the soft parts of the chin which are degenerated, having been circumscribed by a V incision, should be removed at the same time with the anterior tables of the bone. Here the sides of the wound would have to be dissected and separated to some distance (*au loin*) on each side, to be afterwards approximated and united by the suture.

§ V.—*Dental Border.*

When the degeneration does not comprise the entire vertical dimensions of the bone, as for example often happens in cases of epulis and parulis, we are not obliged to divide the whole height of the bone. I have operated upon three patients in this state.

The process which I have followed, is of easy application, and sure. If necessary, detach the inside of the lip or cheek down to the lower border of the jaw bone, without touching the skin. With a cutting instrument, (*sécateur*), in form of a cutting forceps, (*tenaille incisive*) curved almost at a right angle upon its border, I embrace the whole tumor through the mouth, and remove it, taking care to make the section below in the sound part of the bone. One cut ordinarily suffices; but we make two or three successively, if the disease has reached to a great length along the jaw, [*une grande longueur de la mâchoire*—meaning of course the alveolar or dental border. T.] The tumor being now secured by the fingers, forceps or *érigne*, may be detached by a few cuts of the bistoury or scissors, should it still be retained by some bridles of the gum. No hemorrhage ensues, and no dressing is required; an astringent gargle is to be used, and that comprises all.

Dupuytren, MM. Barton, Lallemand, and A. Bérard, (*Dict. de Méd.*, t. XVIII., p. 452,) have also performed this operation, but by another process. M. Barton, by dividing the lip vertically on the middle of the tumor, in order to make a T incision reversed, by means of a lower incision parallel with the border of the jaw, formed two flaps, which were raised up, one to the right and the other to the left. He was then enabled by the saw to divide the bone horizontally, and then vertically in front and behind, upon the alveolar border, in order to complete the isolation of the tumor.

This process which I had recourse to, [*mis en pratique*.—The author does not, I think, mean that he first introduced it into practice. The operation had been repeatedly performed many years before in this country, at least, by Dr. Mott. T.] in the year 1831, with M. Sabatier, upon a woman sixty-five years of age, and which M. Bérard has also adopted, (*suivi*), would not become indispensable unless the disease had proceeded to great extent, and in that case, I should at present prefer commencing with the horizontal incision rather than with the vertical incision of the integuments. As to the trephine, which M. Lallemand had recourse to, I do not think it ought to be employed in any case. All the patients treated by the process I have described, were restored; not one of them died.

§ VI.—*Lower Border.*

The diseases which sometimes render exsection of the jaw necessary, may comprise only the half or two inferior thirds of the height of this bone. Here also the excision of the diseased portion only should be substituted for complete exsection. A young man had an encephaloid tumor, of the size of the fist, which included the chin, and descended to the os hyoides. After having, by repeated incisions, separated it from the lip and neck, I detached it a little from the subjacent tissues. Then causing the lower lip to be raised up, I directed the saw to the root of the incisors, and removed without difficulty the whole of the chin, while leaving untouched the dental border. The patient, after presenting the promise of entire recovery, died at the end of three weeks, but there was found an enormous encephaloid abscess (*enorme caverne cérébroïde*) in the right lung, and a purulent effusion in the pleura.

The different kinds of osteotomes and rowels (*molettes*) would also come into use here; but unless the disease should be situated rather in the side than in the projecting points of the jaw, the hand-saw should have the preference over that of M. Heine, which, on one occasion was employed with success by M. Walther, (*Gaz. Méd. de Paris*, 1834, p. 644, 645.) If the soft parts should be sound, we should form a large flap, semilunar in shape, with its lower border free, and which should be dissected up from the sub-hyoidean region, towards the face, and which would only require afterwards to be allowed to fall down in its place, in order to close up the wound. If on the other hand, however, the integuments would have to be taken away with the tumor, it would be necessary to cut around and dissect them off in such manner as to admit of our elongating their flaps, as in the anaplastic method of Franco, and to proceed afterwards in the same manner as for an ordinary anaplasty.

The advantages of these partial excisions of the jaw are too evident to require from me any further exposition of their merits. Easy and prompt of execution, simple in their consequences, rapid in their cure, and producing but a trivial deformity, are the advantages which indisputably belong to them, and which cannot be said, to the same extent, of the exsection of the whole height of any part whatever of the same bone.

[*Ersection of the Lower Jaw.*—M. Bégin, in a memoir, “*sur la Résection de la Mâchoire Inférieure, considérée dans ses rapports avec les fonctions du Larynx et du Pharynx*,” (see Séance of the Academy of Sciences of Paris, 20th Feb., 1843, in the *Journal des Connaiss.*, &c., de Paris, Mai, 1843, p. 214.) feels himself authorized to come to the following conclusions:—

1. That after the exsection of the entire jaw, (*la grande ablation de la mâchoire inférieure*), the tongue, os hyoides, and larynx may be gently and gradually drawn backwards, so as to cause asphyxia

after a lapse of time, at which it would be supposed there would no longer be any reason to apprehend such a result.

2. That this accident may be prevented, by fixing the os hyoides, by means of the tongue, upon a sort of artificial jaw, until nature has caused new adhesions to the parts.

3. Finally, that by abstaining from forced means of reunion from one side to the other, and by using only simple containing dressings, which excite neither erythism in the nervous system nor retraction (contraction) in the muscles, the surgeon favors the cure without exposing himself to the risk of rendering the deformity greater or more difficult of reparation.

These rules, though they might prove advantageous in extreme cases, in which the totality of the jaw on both sides is removed—cases, however, excessively rare—have never been found necessary in the practice of the American surgeon (Dr. Mott) who was the first to exsect the lower jaw for *osteo-sarcoma*, and who has performed, doubtless, more of these operations, both upon that and the upper jaw, than any other practitioner.

The entire left half of the lower jaw, in a case of *spina ventosa*, was amputated and disarticulated with a perfectly successful result, leaving little or no deformity, by M. V. de Lavacherie, professor at the university of Liege, (Belgium,) as we learn from his treatise, *Memoirs et Observations sur quelques Maladies des Os Maxillaires*, &c., Brussels, 1843. (See also *Journ. des Connaiss.*, Paris, Juin, 1844, p. 241.) The same physician informs us that he has also performed the same operation of amputation and disarticulation of the right half of the lower jaw for *osteo-sarcoma*. This, however, ended fatally immediately after the operation, in consequence of hemorrhage, which, though it did not exceed a pint, was too exhausting in consequence of the hemorrhages which had daily attended the disease for some time. And this unfortunate result occurred, too, notwithstanding the surgeon had adopted the precaution of tying the *primitive carotid* the day before, which, unhappily, did not prevent the tumor from bleeding more or less from the time of the application of the ligature until the operation was performed on the day succeeding, and which operation, therefore, naturally terminated as has been stated. (Loc. cit., p. 242.) For extensive tubercles on the jaw, he has found compression succeed in one case perfectly.

A man aged sixty-eight, with a *spina ventosa* of the left side of the lower jaw, and who had been operated upon for a carcinoma of the lower lip six years before, had the greater portion of the left side of the jaw removed, (*Lond. Med. Gaz.*, Oct. 11, 1844,) by Dr. S. Chisholm, at Inverness, (Scotland,) in June, 1844, and recovered so perfectly that he walked home, sixty miles, two months after the exsection. The portion of bone removed, extended from the side of the symphysis to the articulation—not, as we understand, including the rather difficult and dangerous process of disarticulation of the jaw itself.

M. Blandin (*Gaz. Méd. de Paris*, Juin 14, 1845, p. 381) very re-

cently removed, in a female, the whole left ramus (toute la branche du côté gauche) and a part of the body of the jaw, as far as to the middle of the commissure of the lips on the opposite side; managing so as to save the principal branches of the facial nerve, and thus to preserve the integrity of the movements of the face. In exhibiting this case to the Academy of Medicine of Paris, June 10, 1845, M. Blandin expressed, apparently, much agreeable surprise to find substituted, in place of the exsected bone, a spontaneous, fibrous, bridle-like production, which occupied nearly the whole of the space left by the exsection, and which seemed to unite the two fragments. The consistence of this bridle, he remarks, appears to be similar to that of the jaw of young infants, who have not yet breathed.

This fibrous, or rather fibro-cartilaginous substance, has long been familiarly known in this country, ever since the operation of exsection of the lower jaw was first introduced into surgical practice here by Dr. Mott.

This operation of Dr. Mott, it would appear, is now become domiciliated even in India. Mr. R. O'Shaughnessy, of the Gurnulhattah Dispensary, in a treatise on the *Diseases of the Jaws, their Extirpation, Amputation, &c.*, Calcutta, 1844, (see *British & Foreign Medical Review*, London, No. XXXIX., July, 1845, p. 195, &c.) relates that he had then performed the operation of removal of the upper or lower jaw *five times successfully*, in one of which the osteo-sarcomatous tumor of the lower jaw was as large as a child's head, requiring the extirpation of the whole jaw on both sides, except the ramus of the left! This is close upon the heels of what civilized Europe or America can boast of. In his operations on the upper jaw, we perceive that he disapproves of the extensive incisions of Mr. Liston, but nevertheless continues upon the erroneous plan, as Dr. Mott conceives it to be, of making his incision extend from the zygoma into the centre of the commissure of the mouth, instead of the straight single and simple perpendicular incision of Dr. Mott, from near the inner angle of the eye and along the ala of the nose into the mouth, near the median line of the upper lip. Mr. O'Shaughnessy prefers, however, to make all his exsections with Mr. Liston's bone nippers, using the saw only to divide the malar process where the malar bone may be saved. T.]

ARTICLE VI.—UPPER JAW.

Encouraged by his first successes, and by the instances of destruction of the sinus and certain serious lesions of the upper maxillary bone, which had cured spontaneously, Dupuytren soon conceived that the upper jaw also might be exsected. It also appears that Acoluthus (*Mém. de l'Acad. Royale de Chir.*, t. V., 1819) had already performed this operation, in 1693, for a tumor of the face, and that his patient had recovered. Camper also speaks of a patient in whom the upper maxillary jaw came away entire, and

who, however, survived. Ruysch, (*Obs. Anat. et Chir.*, Obs. 48, p. 67, in French,) in extirpating a fungous excrescence from the palate, removed, at the same time, the carious bone which gave origin to it, and cauterized (*brûla*) the bottom of the wound. In a case of sarcoma, of the size of two fists, mentioned by Planque, (*Bibliot. de Méd.*, t. XXIII., p. 70, in 12mo,) the cheek was divided in order to excise the tumor, and two or three teeth and a portion of the corresponding bone removed with it. The patient recovered. The partial exsection of the upper jaw, in a case of fungus of the sinus, had also been performed by David, (*Sprengel*, t. VIII., p. 281,) and by Beaupreau, (*Acad. de Chir.*, in 12mo, t. XII., p. 56,) who, however, removed only the alveolar border. Siebold (*Annales de Méd. d'Altembourg*, Février, 1808) also relates one of the most remarkable cases of this kind. The tumor, which occupied the left maxillary fossa, had, in the space of twelve years, acquired such volume and assumed an aspect so revolting, that the magistrates had the patient confined to his own apartments. In 1800 this tumor extended from the right canine tooth to the left molar, occupying the whole of that portion of the alveolar border, and made a very considerable protrusion externally. After having separated it from the upper lip, its exsection was made with the saw, and the tumor extirpated entire. The pain and hemorrhage were much less than had been apprehended; the maxillary sinus, which was divided into two cavities, having been laid open, was cauterized with hot iron, and in six weeks the patient left the hospital perfectly cured. Bidloo and Desault, however, who had also both conceived the possibility of this operation, and which moreover had been performed by Deschamps in 1804, and by Klein in 1805, Jæger, *Op. cit.*, p. 12,) confined themselves to recommending it, without, however, ever having, as it appears, performed it.

§ I.—Indications.

These ideas though vague and imperfectly defined, take away however, as we perceive, all the merit of invention from the moderns on the subject which we have under consideration; and which subject moreover is, in reality divided into two parts, that of the exsection and that of the disarticulation of the bone.

M. Paillard, (*Lancette Française*, t. II., p. 264; *Clin. des Hôpitaux*, t. III., p. 81,) asserts, and the bulletins of the faculty establish the fact that Dupuytren, (*Bulletin de la Fac. de Méd.*, t. VII., p. 21,) had recourse to the first of these operations in 1819 and to the second in 1824. M. Pillet, (*Lancette Française*, t. II., p. 284,) who maintains that up to that time M. Gensoul alone had performed this last operation, asserts that the patient of Dupuytren died at the Salpêtrière, and that a portion of the jaw had been left behind. It was in the year 1826, that M. Lizars who also claims priority in this operation, first proposed it, and afterwards in 1827, 1828 and 1830, performed it with success. But as it appears to me, too much importance has been given by all parties to this dis-

pute. From all times past, there have been performed exsections of some portions of the upper jaw; in our times we have gone farther; more at least, and that comprehends the whole question. Though this bone should have been removed in its totality, which is not easy to prove, even that would not merit the title of an invention. This discussion therefore does not deserve any farther attention to be given to it. The merit of M. Gensoul consists in having devised a process by which we are enabled according to fixed and precise rules, to disarticulate the jaw, instead of excising or amputating it in the manner this operation has been performed by Dupuytren, MM. Wattman three times in 1820; Graefe three times in 1823, Textor, Robinson, Jæger, Chelius, (Jæger, *Op. cit.*, p. 12—13,) and Liston and all the other surgeons of whom I am about to speak.

§ II.—Operative Process.

In certain cases Dupuytren confined himself to exsection of the alveolar border only, by means of the cutting pliers, or the gouge and mallet; in other cases he has found it advisable to execute certain incisions upon the face, in order to effect the more complete removal of the osteo-sarcom, and many of his patients who were thus treated were well cured. One of those of M. Gensoul was perfectly re-established. M. Syme, (*Lancet*, 1829, t. II., p. 677,) who made trial of this operation in the beginning of the year 1829, for a cancerous tumor of very considerable volume, thought it advisable to make a crucial incision, one of the branches of which terminated at the corresponding commissure of the lips, then to dissect off, and turn back the four flaps, and to exsect the tumor by means of a saw and chisel, and a very strong scalpel. At the expiration of some months, vegetations of a doubtful character led to the apprehension of a return of the primitive disease.

The three successful cases of M. Lizars, in two of which he previously tied the carotid, having been obtained in diseases, and by processes of various kinds, cannot serve as a basis for the operative manual. The cure of his two first cases also, was only temporary. In disarticulating the upper jaw, M. Robert, (*Gaz. des Hôp.*, 1834,) followed very nearly the process of M. Gensoul; while M. Sanson, (*Rev. Méd.*, 1834, p. 313,) confined himself to excision. M. V. Mott having performed this operation fourteen times, must also have been obliged to employ various processes.

A. M. Gensoul asserts (*Lettre Chir.*, etc., p. 12—49, 1833,) that he has removed the maxillary, malar and palatine bones: that he has eight times extracted and several times excised the first of these bones; that in one case he removed the pterygoid process itself down to its base; that six of his patients recovered, and that in two others the cancer returned. This is his process: A quadrangular flap raised up on the orbit and forehead; four strokes upon the chisel, one on the summit of the external orbital process, one on the zygomatic arch, one on the os unguis, and ascending process,

and the fourth on the middle of the jaw below and under the nose, to detach or to disarticulate the bone, after which some cuts with the bistoury to complete the division of the soft parts, constitute the whole operation.

B. M. Lisfranc laid bare the facial tumor with a V incision, cut through the naso-palatine septum with M. Colombat's pliers, (cisaillies,) and terminated the operation with the gouge and mallet. In 1823, M. A. H. Stevens, [of New-York,] for a similar case made use of a flexible saw which he inserted through the bone by means of a puncture; while in 1824, M. Rogers, [Dr. David L. Rogers, of New-York,] who removed the jaw on both sides down to the pterygoid processes, scarcely found it necessary to divide the lip. To the cases of this operation already known, it is necessary to add the one which M. Piédagnel, (*Bull. de Fér.*, t. XV., p. 294,) observed in 1818, in the service of Beauchêne, that which M. Lafont, (*Arch. Gén. de Méd.*, t. XXVII., p. 264,) communicated to the Academy, the successful case of M. Syme, (*Edinb. & Surgical Jour.*, t. CXXXVII., p. 382,) and that of M. Georgi, (*Bull. de Fér.*, t. X., p. 93.) M. Guthrie, (*Encyclogr. Méd.*, 1836, p. 42—44,) who has performed it three times, was obliged in one of his patients to take away at the same time the malar bone, os unguis and inferior turbinated bone. M. Warren has also perfectly succeeded in his cases. Though M. Regnoli, (*Compte-rendu de la Clin.*, etc., 1837,) removed only the alveolar border, and M. Serre, (*Encyclogr. Méd.*, 1836, p. 104,) confined himself to the excision of the wall of the sinus maxillare, M. Stilling, (*Journ. des Progrès*, t. X., p. 239,) is of opinion that he removed the whole bone. M. Krimer, (*Ibid.*, t. II., p. 5; t. III., p. 239; *Bull. de Fér.*, t. XX., p. 217,) and M. Samel have noticed something still more interesting: in their patients the teeth have been reproduced!

C. *The Author.*—I also have had occasion to perform exsection of the upper jaw in a woman aged forty-five years. All the molar teeth of the left side had been extracted or destroyed. An opening capable of admitting the extremity of the finger, allowed of an easy exploration of the interior of the maxillary sinus, which was covered with bleeding vegetations. The borders of this sinus also in a fungous state were hard and lardaceous, (lardacés) and blended with the surrounding tissues. Many portions of necrosed bone connected with its outer and anterior walls were noticed in the midst of the degeneration, which extended back to the velum of the palate, in front to the incisor teeth, and inwards to near the median line. The operation was performed in the fore-part of July, 1829, at the Hospital of Saint Antoine.

First Stage.—An incision commenced at the commissure of the lips, and carried obliquely upwards, outwards and backwards, as far as the temporal fossa, between the external orbital angle and the external ear, (pavillon,) enabled me to avoid with certainty the duct of the parotid gland, and to raise up in front, after having dissected it, a triangular flap, comprising all the soft parts which cover the malar bone and the canine fossa.

Second Stage.—With one stroke of the saw applied immediately under the orbit, I divided the projecting portion of the zygoma, (os jugal,) and penetrated into the sinus; by means of a very strong scalpel, shaped like a pruning-knife, (serpette,) I divided, after having extracted one of the incisor teeth, the jaw in front, so as to unite the second section with the first; by a third cut I prolonged the incision from the hard parts to the molar tuberosity. By this means I cut round all the lardaceous (lardacés) tissues, a great portion of the necrosed bones, and the totality of the facial walls of the sinus. With the point of the same instrument introduced into the interior of the mouth, I divided the horizontal portion of the vault of the palate in a direction parallel with the median line. I then returned to scrape the floor of the orbit, and made use of the dissecting forceps to extract several lamellæ which remained behind, and which belonged to the palatine bone, the posterior wall of the sinus, or to the orbital cavity itself. In one part, I was obliged to penetrate to the zygomatic fossa, and in another, into the interior of the orbit. I could then satisfy myself that the bones which divide this last cavity from the antrum highmorianum had been destroyed, for the finger, carried to the bottom of the wound, raised the globe of the eye forwards, and reversed it under the upper eyelid.

Third Stage.—Under the fear that some fungosities or fragments of diseased bone might have escaped my researches, I applied the red-hot iron over the whole extent of this large excavation. After having filled the wound with small balls (boulettes) of lint, I united the two lips by means of four needles and the twisted suture, and supported the whole by a simple containing bandage. The general and local symptoms, which were quite serious for two days, soon subsided. On the fifth day the whole wound was cleansed, and I removed the two last points of suture. At the end of eight days the suppuration had ceased to become foetid. When I quitted the service of the hospital three weeks after, the interior of the mouth was of a healthy (vermeil) color, scarcely sensitive, (à peine sensible,) and in progress of cicatrization. I learned that this woman returned home before being completely cured, and that, in some months after, her primitive disease returned. In a patient whom I operated upon in the same hospital in 1830, and in whom nothing more was required than the excision of the left alveolar border, the cure was completed on the twelfth day, and the patient has remained perfectly well ever since.

III. If, however, the disease should seem to require that the whole bone should be removed in the manner of a tumor, the process of M. Gensoul would offer real advantages, not in respect to the form of the flap, but as to the mode by which the jaw is to be extracted. In other respects, whether we use the chisel, saw, rowels, modern osteotomes or the trephine, the incision of the soft parts, such as I have described it farther back, slightly modified if the state of the tumor should make it necessary, will most usually be found to answer; it is difficult, as it seems to me, to imagine one

more simple and easy. The crucial incision employed by M. Syme, incurs too great a risk of wounding the duct of Stenon, and does not offer any greater certainty of laying bare the parts that we wish to remove. The employment of a small sickle-scalpel (*vid. supra*) was also found by me to be exceedingly useful, and seems calculated to give great assistance under such circumstances. If the alveolar border only should be affected, we should be enabled also, by means of the cutting pliers, to remove the whole disease without making any incision into the lips. In the contrary case, should it become necessary, we ought to divide the tissues on each side, following the oblique line, which I have described above. This operation, moreover, is one of those in which the manual must, in a measure, be regulated by each particular case, and one in which we should guard ourselves against being restricted by any rules that are too rigorous.

The extraction of a simple sequestrum comprising the greater part of the bone, an example of which occurred in the service of M. Roux, in 1829, does not, either in the upper or lower jaw, leave near as great a deformity as the operation of exsection. A new production almost always ultimately succeeds to the ancient one and it would be in such cases, only that we might, *perhaps*, with MM. Krimer and Samel or Samuel, admit the possibility of the reproduction of some of the teeth.

[EXSECTION OF THE UPPER JAW.]

In February, 1843, (Cormack's *London and Edinburgh Monthly Journal*, &c., June, 1843, p. 495, &c.,) Mr. Syme, of Edinburgh, states that he removed in a man aged 26, a singular tumor of five months' growth, which occupied nearly the whole left side of the upper jaw up to the orbit, involving also the antrum which was found on its anterior wall, to have been reduced to a shell of bone from pressure of pendulous bodies of an epulotic character growing within it, and similar in consistence with like vegetations upon the gum and palate. A curvilinear incision, with convexity downwards, was made through the cheek, from the prominence of the cheek to the angle of the mouth and the malar, nasal and palatal connections of the diseased mass successively divided, the external parts which readily united, scarcely leaving any deformity visible. Mr. Syme is in error in dating either the curvilinear incision, or the present mode of detaching the osseous parts in such exsections, as having commenced with or taken their origin or departure from an exsection he made of the superior maxillary bone, in 1829, (*Edinburgh Medical and Surgical Journal*, July, 1829.) Dr. Mott had many years before that date always adopted the curved incision in question in his exsections of both the upper and lower jaw bones, (see his cases at the end of this volume,) also Prof. Velpeau was, we believe, anterior to Mr. Syme in this matter, (see his letter to Dr. Mott, also Dr. Mott's Remarks appended thereto, Preface to Vol. I. of this work.) It is inexact, therefore, for Mr. Syme to assert,

(Cormack, *ib.*, *loc. cit.*, p. 496) that in operations either on the upper or lower jaw, it had hitherto "always seemed necessary to make a double or complicated incision, so as to permit the formation of a flap exposing the fore-part of the bone." Mr. Liston may have done so, (*Loc. cit.*, p. 497,) but at all events this has never been the practice with Dr. Mott. Nor in ordinary cases has Dr. Mott generally found it necessary to divide the cheek at all as Mr. Syme does, in order to have space to remove "tumors of the gum and lower part of the superior maxillary bone;" the raising of the lip up, and dissecting it upwards to the proper extent, from its connections with the jaw at its bucco-maxillary groove, commissure or attachment being quite sufficient for the clean excision of the whole alveolar process to, or considerably above its union with the superior maxilla, which operation, in many osteosarcomatous enlargements, is frequently all that is required to arrive at the sound portion of the bones, provided the operation is performed early in the disease. In a delicate little girl, aged 7, of West India birth, and therefore more liable to possess, as she did, a highly organized nervous temperament, Dr. Mott, in a case of this kind, was obliged, from the hot season and the danger of spasms, to make three successive halts or short stops in the operation, which he would, under such circumstances always enjoin; as it is surprising how quickly the little patient thus refreshed by a few moments on the bed or its parent's lap, (as in this case,) and a mouthful or two of wine and water, and some pleasant stimulating salt to the nose, was invigorated, and how much better enabled to sustain the mutilations which were to be made, and which, it must be confessed, are calculated to produce much pain. Dr. Mott, as he generally does in such cases, where the incisors, cuspid, bicuspid and one or two molars only are involved in the livid, fungoid, hypertrophied border of one side only, began by extracting the teeth which were loose and easily detached, then plunged a very narrow-bladed, sharp, straight bistoury through the mass at the posterior extremity of, and quite above, the diseased soft parts and degenerated alveoli. Immediately inserting a stiff, straight, narrow saw, of corresponding shape and width of blade, through this aperture, he rapidly sawed from above downwards; then doing the same on the other extremity of the diseased parts in front, the mass thus bounded by the two short, transverse and perpendicular divisions, was readily excised by a curved saw which united the upper extremities of these divisions, by scooping out, as it were, all the altered structures, making horizontally to the extent of from two and a half to three inches, a curved connecting cut with its convexity upwards, and completely through the healthy bone, and above the disease.

M. de Lavacherie, professor of the University of Liege, Belgium, (see his *Memoir et Observations sur quelques Maladies des Os Maxillaires*, Brussels, 1843; also, *Journ. des Connaiss.*, &c., Paris, June, 1844, p. 242,) has, in a case of hydropsy of the right *sinus maxillare*, excised the anterior osseous wall with perfect success.

In a case of *osteosarcoma* of the right upper jaw, wherein he amputated the *maxillary and malar bones, with the zygomatic process, and a portion of the pterygoid process*, the disease soon returned, and the patient died.

In another case, however, where he extirpated in a woman the right *malar bone and zygomatic process* on the same side also for *osteosarcoma*, the cure was complete, so that in a year after she gave birth to an infant remarkably robust in its health and strength, surpassing, in these respects, all her other children. T.]

ARTICLE VII.—EXSECTION OF THE LARYNX AND TRACHEA.

Necrosis and caries of the *os hyoides*, and cartilages of the larynx and trachea, may also require exsection. A sequestrum with a fistulous opening into the air passage, (*fistule aérienne*), the origin of which J. L. Petit (*Acad. de Chir.*, p. 185, t. II.) ascribed to syphilis, came near falling into the trachea. It became necessary to attach a thread to it until it came away entirely, and afterwards to have recourse to tents of lint imbued with wax and cocoa melted. We must evidently attend in good season to the means of securing a necrosis of this description, which, perhaps, it would be better to detach, and then unite by means of suture, the portion of skin which covered it to the neighboring parts. In a case mentioned by Marchettis, (Bonet, t. III., p. 240, Obs. 40,) the caries was rasped, and thus perfectly destroyed. The fistula existed between two of the rings of the trachea. Having dilated it with a sponge, the rasp could be applied to the diseased cartilages on both sides, which could thus be conveniently scraped. Having laid open the ulcerous passage, I was enabled to excise a portion of the *os hyoides*, and to cure a fistula which in one case had existed eight years, and in another three, being two adult patients whom I operated upon with M. Pegot, in 1834, and with the other with M. Leclerc in 1836.

ARTICLE VIII.—STERNUM.

The sternum being a spongy, thick and superficial bone, is naturally liable to all the diseases common to the osseous system; consequently attention has been early directed to the modes of laying it bare and of excising or perforating it. The abscesses which form in the anterior separation of the mediastinum, and which are thus imprisoned as it were in the chest, might easily be cured, if an aperture should exist in the sternum. When this bone is carious or necrosed, it may become itself the source of dangerous suppurations, or accidents which almost always ultimately have a fatal termination. [In a case of an old man aged about 70, of broken down constitution, and vitiated by neglected or improper treatment for syphilitic disease many years before, the middle bone of the sternum had been for a long time carious, and finally changed to a true necrosis, and penetrated into the mediastinum, inducing pulmonary symptoms, expectoration and hectic which in a few months

carried him off. The autopsy, I found, confirmed my diagnosis and the fetor emitted from the slight perforation which the necrosis had worked through the bone, was remarked as peculiarly offensive. T.]

Whatever Lèveillé may say to the contrary, there is every reason to believe that Galen, (Teyrilhe, *Histoire de la Méd.*, etc.,) had performed exsection upon this bone, in that patient in whom he was clearly enabled to see the pulsations of the heart. De la Martinière, (*Mémoires de l'Acad. Roy. de Chir.*,) shows by the observations of Mesnier, Alaric, Sedilier, Lecat and Ferrand, as has been proved also by those of Labissière, J. L. Petit, Ravaton, Genouville, Cullerier, (Champion, *Traité de la Résection*, p. 42,) Boyer, (*Malad. Chir.*, t. III., p. 526,) Jæger, (*Gaz. Méd. de Paris*, 1833, p. 645,) and Gillette, (*Journ. Hebdom.*, t. II., p. 228,) that exsection or trephining of the sternum is very frequently indicated. Colombus Purmann, (Champion, *Op. cit.*, p. 41,) and Marchettis, therefore were right in recommending it or in having recourse to it. Guilleméau, (*Œuvres de Chir.*, p. 651, 1649,) had already recommended the trephine for extracting a ball buried (enchatonné,) in the sternum; De La Martinière, (*Mém. de l'Acad. de Chir.*, t. IV., p. 545, in 4to,) in a case of fracture extracted four fragments of the bone by means of the elevator; M. Mosque, (*Application du Trépan au Sternum*, p. 13, No. 439, *Thèse de Paris*,) mentions a fracture of the sternum with depression, and complicated with emphysema and effusion, which were laid bare by the trephine. An individual received the ball of a pistol, the muzzle resting on the sternum, (à bout portant sur le sternum,) and the ball was lost in the chest. The parts were dilated, splinters removed, the trephine applied, and the wadding and portions of the clothing extracted, which was followed by taking half a palette of blood. The patient was at the point of death, says Ravaton, (*Chir. d'Arm.*, p. 215–239, obs. 50;) the ball was not extracted till the thirteenth day, but the case notwithstanding got well.

In the case related by Galen, (*Opera*, lib. VII., cap. 13,) and which occurred in the servant of Marcellus, the disease was caused by a kick on the breast, (bréchet or brisket;) “abscess after four months, incision, cicatrization; new inflammation and abscess, cicatrization impossible; consultation of physicians; all pronounce the disease a sphacelus with corruption of the chest. Afraid to penetrate into the chest, no one dares attempt to exsect the diseased bone. Galen promises to remove it without opening into the chest; but without guaranteeing to make a perfect cure of the case! The part being laid bare, no other portion of the sternum was found diseased, which inspired courage and confidence in the operative process. Having cut through the corrupted bone at the place where it is adherent to the point of the sheath of the heart, and the heart being visible through it, (se montrant à nu) because its sheath or pericardium was rotten, (pourri,) Galen and his assistants formed a bad prognosis of the case; nevertheless he recovered perfectly in a short time.”

We should not, however, decide in these cases upon exsec-

tion unless the existence of an abscess underneath the sternum was positively indicated, or unless it was evident by the fistulas or the explorations with the probe, that there was a caries or necrosis in the neighborhood. I have once performed this operation under these circumstances. It was for a necrosis of long standing and altogether local; I required only the gouge and mallet to destroy it completely, as it did not penetrate to the mediastinum. In some cases we are obliged to make use afterwards of the hot iron to eradicate the remains of the caries. The trephine also often becomes indispensable, not that it is useful, as Duverney, (*Malad. des Os*, t. II., p. 448,) has strangely supposed, to leave in its place the bony disc circumscribed by the trephine, after having sawed around it; but because it would be difficult to penetrate the sternum through and through, in any other manner. At the present day, however, the concave rowels (molettes) enable us to excavate the bone so extensively and so deeply, that the trephine would no longer be required except to penetrate directly to the anterior separation of the mediastinum; by means of the osteotome of M. Heine, M. Dietz, (*Gaz. Méd.*, 1834, p. 644,) or Jæger, (*Jæger, Operat. Resect.*, &c., p. 17,) was enabled to remove a semilunar portion of the length of two inches. (See *Trephining*.)

Here, less than in any other part of the body, ought the wound to be united by first intention; the dressings therefore should be flat, and as I have described in the preceding exsections.

ARTICLE IX.—THE VERTEBRÆ.

By their nature and their functions, and especially by their deep situation, the vertebræ unfortunately are out of the reach of the action of surgical instruments, at least so far as regards their body and transverse processes. The spinous processes, however, have already been several times successfully excised. In operating at the Hotel Dieu on a woman with a tumor at the nape of the neck, Dupuytren removed at the same time the spinous process of the seventh vertebra. M. A. G. Smith (*Jour. des Progrès*, t. XVII., p. 281, *Jour. Hebd.*, t. V.) also removed the spinous processes and laminae of several of the dorsal vertebræ in an individual who had depressed them in, and was paraplegic, in consequence of a fracture in this region. The operation, says the author, was followed by perfect success, as his patient recovered the faculty of walking.

This excision, which was advised also by Vigaroux, (*Hevin, Cours de Pathol.*, etc., t. II., p. 205,) and by M. J. Cloquet, was also performed twice by M. Tyrell in 1822 and 1827; by Cline (Olivier, *Maladies de la Moelle*, etc., p. 222, Jæger, *Op. cit.*) in 1814; by M. Wickham in 1817, and also by another English surgeon. M. Heine (*Gaz. Méd.*, 1834, p. 645) also aided by his osteotome has not feared to undertake it. M. Roux also was obliged to have recourse to it in removing an enormous cancerous mass from the back in a patient whom I saw, and M. Holscher had done the same in 1828.

Without admitting with Bartholin, (Bonet, *Corps de Méd.*, t. IV.,

p. 555,) who, on the testimony of the Duke of Lünebourg, affirms that two of the dorsal vertebræ were carried away by a cannon-ball without causing the death of the patient, I will nevertheless allow that the excision or exsection of every projecting part of the spinous processes or of the vertebral laminæ, does not appear to me to have anything in it impracticable or even unreasonable. Having therefore laid bare the root of these osseous projections by means of suitable incisions, I would recommend that we should excise the spinous processes with the simple cutting pliers, or if the laminæ of the vertebræ were to be removed, with the crested saw (*scie en crête de coq*) or rowel saws either of M. Heine, M. Légeuillou or M. Martin. As the spinal marrow lies some lines in front, the instrument would not wound it if the surgeon took the precaution of not going beyond the plane of the roots of the transverse processes. So long as it concerns only the spinous process, the operation cannot, properly speaking, be either very serious or very difficult. If the vertebral plates, however, are to be penetrated, there will be real danger, less on account of the risk of traumatic lesions to the spinal marrow, than on account of the inflammation which may soon be produced in the interior of the arachnoid cavity, or on the surface of its appropriate membrane. We must guard therefore in such cases against approximating the lips of the wound, and not fail to dress it lightly and with the aid of small balls of lint, in order that cicatrization may only take place by second intention.

ARTICLE X.—THE RIBS.

Among the exsections of the bones of the trunk, there is one which has more especially attracted the attention of modern observers: I mean exsection of the ribs, performed in other times by Galen, Levacher, (*Mercur de France*, Avril, 1758,) Gooch, (*Gaz. Salut.*, No. 28, 1775,) Sédillier, Lecat, (*Prix de l'Acad. de Chir.*, t. II., p. 34, 12mo,) Ferrand, M. Larrey, (communicated by M. Jacquier to M. Champion, 1807,) Beullac (*Soc. Méd. de Marseilles*, 1817,) &c.; an operation which it is said the Hindoos (Indiens) also frequently practise in the treatment of *Cawso*, (*Journal Univers. des Sc. Méd.*, October, 1818,) and which they designate under a particular name. The ancient *Journal Encyclopédique* contains a singular case of this exsection. Suif excised two ribs from a man named Botague, in such manner as to be enabled to introduce the fist into the chest. A portion of the diseased (*gâté*) lung was removed, and the patient got well! Nevertheless, it was scarcely thought of any more, until in the year 1818, when M. Richerand (*Bull. de la Fac. de Méd.*, t. VI., p. 104) performed this operation upon an officer of health, affected with cancer of the thorax. It is known that since then M. Cittadini (*Arch. Gén. de Méd.*, t. XVIII.) has twice performed it with success in Italy. Percy (*Dict. des Sc. Méd.*, t. LXXII.; *Jour. de Méd.*, 1820, t. LXXIII., p. 354,) also states that he performed it successfully on an officer named Muller, who had two of his ribs carious, caused by a gun-

shot wound. The Journals also relate that it has been made trial of also at the hospital Beaujon, by M. Blandin, at La Charité by M. Roux, and in America by M. Mott. The case of M. Richerand is unquestionably the most remarkable of all. It became necessary to remove the middle portions of four ribs to the extent of several inches. The pleura which was greatly thickened, had also to be removed, so that the pulsations of the heart in the pericardium were exposed naked to the sight. The results of this operation at first were of the most satisfactory nature; but at the expiration of a few months before the wound had completely cicatrized, the cancer re-generated and ended in death.

Operative Process.—The patient being placed upon his back, if the disease is in front, and on his belly if it is behind, and on the side in all other cases, is to be held securely in his position by the assistants. A pillow or cushion is to be placed under the opposite flank, in order to raise up and stretch the diseased side. After having laid bare the rib or ribs we propose to exsect, and prolonged the incisions in front and behind beyond the extent of the disease, we make use of a crested or chain saw, or a rowel-saw, either flat or of the mushroom form, or we use only the kind of pliers [espèce de force, a sort of *force* or *forcer*, vid. sup. T.] which is employed in the amphitheatres, and known under the name of the sector (*sécateur* or cutter.) This last mentioned instrument, however, would have to be modified if we used it on living man. Its blades would have to be narrower and sharper, in order to take up less space and to avoid wounding the soft parts. Its branches also should be longer by one-third, in order to give the operator more power. Constructed in this manner it has appeared to me to render the operation very simple in the three cases in which I have employed it. We commence with either extremity of the rib and finish with the opposite one; it is, however, better to make the section on the posterior part of the rib first. We must take particular care to avoid wounding the pleura, which, as has been noticed by all observers, is ordinarily in these cases manifestly much thickened. If, however, it should be found to be extensively diseased, and especially if it is the seat of a cancerous degeneration, we must not hesitate in removing it. Herissant, (*Acad. des Sciences*, 1643, p. 71,) who opened it by mistake, had no reason to repent of having done so. To escape wounding this membrane, which, according to Botal, Galen succeeded in avoiding, though he removed an entire rib, it is important to scrape carefully each border of the bone, and not to incline the point of the bistoury towards the intercostal space. Before going any farther we should detach its inner surface with the blunt point of a curved sound, or draw it outside and towards us by means of a blunt hook. In this manner we divide only the inferior artery in each rib that we take away. The blood also in certain persons flows copiously during the operation, and authors have done wrong in omitting to notice this hemorrhage. Fortunately tamponing properly applied, is almost always sufficient to put a stop to it; for it would be a difficult matter to seize the arteries in order to twist or tie them. The

wound being irregular (inégale) and contused is to be dressed flat ; and we should incur the risk of serious dangers if we attempted to heal by first intention.

Appreciation.—Exsection of the ribs which is recommended in general terms by Celsus, (*De Re Med.*, lib. VIII., c. 2,) by Soranus, (Champion, *Traité de la Résect.*, p. 44,) in cases of compound fractures ; by Arcæus in order to dry up certain fistulous discharges ; and which was actually performed in cases of caries and necrosis by Séverin, (Champion, *Traité*, inéd., p. 44,) J. L. Petit, (*Œuv. Chir.*, t. II., p. 25,) Duverney, David, Lapeyronie, and Desault, (Champion, *Op. cit.*, p. 44 ; *Jour. de Chir.*, t. I., p. 317,) is an operation neither very dangerous nor very difficult. Besides the practitioners whom I have mentioned above, MM. Anthony, McDowell and Jæger, (Coulon, *Thèse*, Wurtzburg, 1833,) have also performed it with success. Aymar (*Bonet*, t. IV., p. 95, obs. 105, 96) in a case of scirrhus removed three inches from the fifth, sixth, and seventh left ribs. Moreau, (Champion, *Traité de la Résect.*, p. 50,) who was obliged to remove a portion of the sternum at the same time with the fifth and sixth cartilages of the right ribs, succeeded in curing his patient. M. Clot, (*Jour. Hebd.*, 1835, t. II., p. 296, 297 ; *Compte-rendu de l'Ecole d'Abouzebel*, 1832, p. 50,) in removing the second rib in a carious state in one case, the sixth in another, and the seventh and eighth in a third, was no less fortunate. M. Warren who extirpated the seventh rib in a case of osteo-sarcoma, afterwards the sixth and seventh affected with caries in another patient, and M. Textor, who in 1837 extirpated the tenth or eleventh ribs also in a carious state, were equally successful. I have myself performed the operation three times, and none of the cases died. This, however, is no reason for deciding upon the operation lightly. The patient of M. Roux died in consequence of the operation, so that without admitting with Lassus that caries of the ribs is an incurable disease, I am ready to allow that it may exist for a great number of years without impairing the general health. The operation, moreover, has caused the death of many other patients.

The excision of the true ribs must always be a serious operation. It is true that when the disease is situated in one of the three last we are in no fear of wounding the viscera of the thorax ; but we are not to forget that we are then in the neighborhood of the peritoneum and the abdominal organs. The two floating ribs, moreover, require some special precautions. As they are free at their anterior extremity, it is important to support them with a hook in this direction, while we are isolating and dividing them posteriorly. From their great mobility the sector (*sécateur*) is infinitely more convenient for making their division than any other instrument, and their section anteriorly becomes unnecessary. Adopting these precepts I was enabled to effect the exsection of the twelfth rib on the right side in a young man aged seventeen, without any very great difficulty.

Another circumstance not to be forgotten is this, that the caries

or necrosis which we propose to remove may be only the symptom or effect of a deep-seated disease, and may not be limited, as we might be tempted to think. In four men who solicited me to perform the operation, and which I declined to do, the affection of the ribs in one case originated from caries of one of the vertebræ, and in the others from pulmonary tubercles. In conclusion, this exsection is not to be performed unless the disease, besides being circumscribed, is altogether local, or unless by its presence it threatens to give rise to serious accidents.

ARTICLE XI.—THE PELVIS.

Many points of the bones of the pelvis project so much outwardly as to have naturally suggested to the minds of surgeons the idea of attempting their exsection.

§ I.

The *coccyx* and *point of the sacrum*, among others, have often been removed for caries or necrosis, whether caused by a fall on the breech or by any other force, or by some internal disease.

Bourleyre (*Anc. Jour. de Méd.*, t. XLIII., p. 316) gives the history of a caries which perforated through and through the sacrum. The bone in its middle portion was denuded to the size of a sou, and pierced from above downwards; but no treatment was used but that of bourdonnets, (see Vol. I.—rolls of lint,) saturated with mercurial water, (eau mercurielle—proto-nitrate of mercury.) Champeaux (*Gazette Salulaire*, 1769, No. 31, p. 3) mentions the case of a female aged thirty-six years, who in consequence of falling upon a cart wheel from a height of more than twenty feet, had a necrosis of the sacrum. A longitudinal incision from the middle part of the bone as far as the extremity of the os coccygis, enabled the surgeon to ascertain with his finger that the sacrum was fractured throughout the greater portion of its extent, and that most of the splinters were loose. He thus extracted by means of the forceps (tenettes) more than twenty pieces of bone, and the cure was accomplished at the expiration of two and a half months.

The operation, moreover, in such cases is so easy that it scarcely requires to be described. The patient should have a pillow placed under the belly, and ought to lie down in that position on the border or foot of the bed. Nor would there be any objection to placing him in the same manner as for the operation of fistula in ano or for stone.

The sides of the breech being then held apart, the surgeon incises upon the median line from the neighborhood of the anus to the posterior surface of the pelvis; then separating the lips of the wound as he continues to detach them, he prepares for seizing hold of and raising up the diseased bone. For that purpose a good pair of forceps will answer if the osseous fragment is moveable; in the contrary case he proceeds with a mushroom-shaped saw if there is only a super-

ficial necrosis or caries, or with the flat rowel saw in case of a deep-seated lesion, to cut through the whole thickness of the bone, at some lines outside of (au-dessus) the diseased region. A chisel or spatula, or any other solid lever, inserted into the track of the saw, would then suffice to detach (faire basculer) the bone and thus complete its exsection. Seizing it then with an érigne, a forceps or the fingers, nothing more remains, in order to extract it entirely, than to gradually detach from it the fibro-cellular tissues upon its borders and its deep-seated (internal) surface. The wound being dressed with balls of lint, the perforated linen and a plumasseau, (see Vol. I.,) would require moreover the same kind of bandage as all other wounds of the anal region.

M. Van Onsenort, who extirpated the os coccygis in consequence of a fistula kept open by a caries of this bone, proceeded in the following manner. With the fore-finger of the left hand introduced into the rectum he supported the rectum. An incision was then made on its middle part, from the base to the apex (sommet) of the bone. By means of a transverse incision made on a line with its point, he was enabled to detach this latter and to separate the soft parts from the inner side of the coccyx. The operation terminated with disarticulation, and the patient promptly recovered without any accidents. M. Kerst has seen a case in which the coccyx was entirely detached from the sacrum and expelled spontaneously. The patient ultimately recovered.

§ II.

The *tuberosity of the ischium* could without doubt, should its diseased condition require it, be exsected in the same way as the great trochanter. Maunoir (*Questions de Chirur., Traité des Ulcères*, p. 164) has published a case of this kind. The caries had proceeded to great extent. After the incision two cauteries were applied, heated to a white heat, and then recourse was had to tamponing, (tamponnement, *i. e.*, plugging or tenting a wound, see Vol. I.) Two months later, and after repeated attempts, the surgeon succeeded in extracting a portion of the ischium of the size of a small pullet's egg, when a cure was effected. But I have not been enabled to ascertain that any person since up to the present time has ever suggested or any other surgeon had occasion to perform this operation.

§ III.

It is not, however, altogether the same with the *spine of the ilium* (crête iliaque.) The extent and superficial position of this border of the pelvis, expose it to the action of external violence of every description. Thus is it often the seat of fractures, contusions, and also of caries and necrosis. Abscesses at the bottom of the gluteal region (au fond de la fesse) and in the internal iliac fossa, have also more than once led to the necrosis, and afterwards to the perfora-

tion, of the ilium (*os coxal.*) It is easy to conceive, therefore, that it may be advantageous to remove a portion of it in order to preserve the remainder. It is asserted that Leauté (*Le Dran, Obs. de Chir.*, t. II., p. 265) once exsected the spine of the ilium successfully. De Lamartinière, who recommends trephining the iliac fossa, was imitated by Boucher, (*Séance Pub. de l'Acad.*, in 4to, Paris, 1779; Sprengel, t. III., p. 33,) who thus gave egress to an internal abscess in the pelvis. Manne, (*Traité Élém. des Maladies des Os*, p. 186, 1789,) having met with a comminuted fracture [of the ilium] had recourse to incisions to raise up or extract the displaced fragments of bone, and applied the trephine to the neighboring portion in order to raise up those portions which the elevator could not adjust, and to extract the foreign substances. A fact noticed by Arrachard (*Mém. de Chir.*, p. 269, 1805) at the hospital of La Charité, proves indeed that the bones of the ilium may thus be nearly all removed without causing death. Theden (*Nouv. Obs. et Expériences pour enrichir la Chirurgie et la Médecine*, 2e part., chap. III., p. 48-49) speaking of the trephine for the hip, cites a case in which a ball was accidentally lodged (*enfoncée*) in the pelvis, and extracted by means of this instrument. Weidmann, (*Traité de la Nécrose*, p. 111) also has seen a sequestrum in the diploe of the ilium, enclosed in a new bony encasement, without any external opening (cloaque) being noticed in its neighborhood. [See our note, *supra*, on the *Formation and Growth of Bones*, &c.; especially the observations of M. Flourens, which throw such new and important light on this subject. T.] I have met with two patients who would evidently have derived some advantage from exsection, if they had been willing to submit to it. I have seen two others, in whom, if the trephine had been applied to the bottom of an abscess in the external iliac fossa, the necrosed portion of the bone might have been easily removed.

The process to be followed would be simple and easy. An incision, parallel with the border of the pelvis, to be prolonged in front and behind an inch beyond the limits of the diseased portion, would ordinarily suffice. Separating the lips of this wound apart by dissection, we could, if it were necessary, detach, without fear, the lower one, as far down as on a line with the insertion of the gluteus minimus muscle. In order to avoid the anterior circumflex artery, it would be necessary to graze very near the bone, while pushing to the inner side the upper lip of the wound. It is easy to perceive that, by means of the crested or the ordinary saw, directed transversely from without inwards, while the abdomen was protected by a piece of pasteboard, wood, or fold of linen, we would be enabled to remove the diseased portions of the spine of the ilium to any extent desirable.

Should the affection consist only of a very circumscribed point of necrosis or caries, it could also be removed with the mushroom-shaped rowel saw, or by the chisel.

At the bottom of the iliac fossa, there could be no fixed rules for the operation. One or several incisions to lay the bone bare, and one

or more applications of the crown of the trephine, unless we should prefer the rowel saws of M. Charrière, or the osteotome of M. Heine, is all that we can indicate of the general course to be pursued.

[These limited carious or *necrotic* affections are sometimes, though rarely, seen on the crest of the ilium, in marasmal, broken-down cases, from improper treatment of syphilis. The *purulent diathesis*, which is occasionally noticed in such cases, will also, as I have seen, attack the thin layer of superincumbent tissues on the antero-superior and antero-inferior spinous processes, after which the supuration involves these prominences in caries, laying bare a portion of the cavity of the pelvis upon the internal iliac fossa. Yet I have seen a case of this kind which gave no pain, care or trouble to the patient, and where this *dark hole* into the pelvic cavern had existed for a year, was accompanied by no discharge, but presented, to say the least of it, a very curious appearance. T.]

§ IV.

The *pubes* themselves also may be submitted to exsection. Desault (Chopart, *Maladies des Voies Urinaires*) mentions a lesion of the bladder, caused by a splinter of the pelvis; the fragment was extracted, and a sound placed in the urethra, when the patient got well. A sequestrum of the pubis having made its way to near the groin, caused an abscess, and afterwards an ulcer, which reopened and closed up several times without effecting a definitive cure, until the splinter of bone itself was expelled, which was nine lines long by two in breadth, (J. L. Petit, *Œuvres Posthum.*, t. II., p. 33.) A portion of more than two inches of the pubis, which had been fractured and become detached, was removed by Maret, (*Mém. de l'Acad. de Dijon*, t. II. ;) the horizontal position, with flexion and eversion (*écartement*) of the thigh, in order to prevent the narrowing of the pelvis, enabled this surgeon to obtain a callus which filled up the void left by the loss of substance of the bone, and accomplished the cure in a short time.

ARTICLE XII.—THE THORACIC EXTREMITIES.

When the disease occupies the limbs, we have reason to hope that, by excising some portion of the body of the bones, we may render amputation unnecessary, and preserve certain important organs (*organes*) to the patient. Whether it be caries, or necrosis, or any other morbid production whatever, it is easy to conceive that, in order to destroy the totality of the disease, it will be sufficient to remove with it the whole thickness of the calibre; at other times, only a plate (*plaque*) of the bone. In this manner, everything above and below the disease is so much gained to the organism, and the surgeon in reality destroys only the portion which it is impossible to save. We thus avoid removing a great extent of sound parts for a small extent of diseased tissues. Viewed under this aspect, exsection of the bones in our times has made substan-

ual acquisitions, (véritables progrès.) Thanks to the labors of Hey, Moreau, Champion, Jæger, and Roux, and a multitude of modern practitioners, we no longer perform amputation of the limbs for an isolated disease of some of the bones which enter into their composition. Nevertheless, we must guard ourselves against falling into the opposite extreme or that in which surgeons had so long continued. To be enabled to substitute with advantage exsection of the body of the bones for amputation, we must be sure of removing the whole of the disease. But every one knows that it is usually exceedingly difficult to establish (préciser) the limit of a caries or necrosis. Without that, however, the patient incurs the risk, after having undergone an operation which is generally tedious and difficult, of being obliged to submit also to amputation.

All other things being equal, amputation is more prompt and easy, and more certain in its result, than exsection. The latter, which necessarily exacts a delicate dissection, and multiplied incisions, and more numerous explorations, (tâtonnements,) and which leaves irregular, extensive, and more or less contused wounds, is, on the other hand, accompanied with less danger to life, and possesses the immense superiority of not mutilating the patient, and of *only altering sometimes, but not abolishing the functions of the part.*

In fine, in order that exsection should have the preference, there should be no doubt as to the importance of the organs which it will enable us to preserve, or as to the possibility of our leaving the articulations intact, while at the same time we remove the whole disease.

Caries being ordinarily very circumscribed in extent, scarcely ever compromising life and almost always becoming ultimately restricted within certain limitations, cannot require exsection, unless it should have existed for a considerable length of time. We may, moreover, say of it, as of gangrene and of diffused inflammations in general, that we should not think of removing it until the constitution has put a definitive terminus to the progress of the malady.

As to *necrosis*, it is a disease so little painful, so slow in its progress, so little serious in itself, and one which gives such trifling inconvenience to the patient, that it would be censurable to commence its treatment at once with surgical remedies. Never can necrosis justify exsection in the *diaphysis* of the bones of the limbs, until the morbid process shall have separated it from the living tissues. Before thinking of the operation, therefore, we should make ourselves perfectly well assured that the sequestrum, or necrosed fragment, already possesses a certain degree of mobility, and that it is positively isolated from the rest of the bone. Until that takes place, the necrosis may give rise to pain, inflammations, and fistulas, and stimulate to incessant suppurations, and that for a number of years, which it is impossible to determine; but this does not make it proper that we should proceed to exsection.

This species of exsection is, moreover, applicable to the *short bones*, as well as to the long and flat bones. In the long bones, it

may be had recourse to, both upon the middle portion and the extremities ; its characteristic feature lies in this : that it respects the synovial or articular cavities. It also interrupts, sometimes completely, sometimes only partially, the continuity of the diseased bone ; and what I have said, in this point of view, of necrosis, may be applied to all the other organic affections of the osseous system.

§ 1.—*Bones of the Hand.*

The bones of the hand are charged with such important functions, that we are always exceedingly fortunate in being enabled to preserve any of them. On the other hand, they are so short that their diseases rarely allow our saving the articular extremities, and of destroying only their middle portion.

Supposing it were possible, in certain cases, to remove only the body of the bone, we ought to ask ourselves the question whether the corresponding finger would not thereby become more inconvenient than useful after the operation. Certain facts, however, authorize me in asserting that, in the phalanges, we might remove their middle portion, should their articulations in reality be in a sound state. "When the middle phalanx only is corrupted, [corrupted, *i.e.*, necrosed or diseased. T.] says Lembedt, (*Comment., ou Œuvres Chirurgicales*, p. 397, 1671, in 4to,) we lay it bare by two incisions—one on each side of the finger—in order to avoid the tendons employed in flexion and extension. If the necessities of the disease should require the section of either one or the other set of these tendons, we are to preserve the flexors. The bones being laid bare, we macerate [*mortifierons*, *i.e.*, in this antiquated phraseology and practice, favor their dissolution or decomposition. T.] them. After the abscess, (*i.e.*, the separation of the bone,) the first phalanx approximates to the last, and their coaptation (*entre-touchement*) renders the action and use of the finger commodious, (*agréables*.)"

With the instruments which the surgeon of the present times, has at his command, the operation is neither difficult nor dangerous. If there are wounds or fistulous passages, we enlarge them by dilating the tissues in the direction of the finger. By means of a strong pair of forceps the necrosed fragments are extracted, and with the rasp we destroy the carious portions. If the bone is diseased throughout its whole extent, and there is no convenient opening through the skin, we make an incision upon the dorsal region of the finger, from one extremity of the phalanx to the other. We afterwards detach the tissues in front and posteriorly, with the bistoury ; then by means of Liston's pliers, or the articulated, or the cultellaire-saw, we make the section in succession of the two extremities of the diseased portion (fragment,) of the phalanx.

A. *Phalanges*.—The finger dressed in the same way as if it were fractured, shortens, during the progress of the cure ; but a sort of osteo-fibrous tissue or bridle, ultimately unites the two ends in a solid manner, while the tendons in a greater or less space of time, restore to (*redonner*) the ungual phalanx and the other

phalanges preserved, a certain degree of mobility. This, at least, is what I have observed to take place in three patients, who had thus lost, one of them the middle phalanx, and the two others the metacarpal phalanx, of one of the fingers. Viguerie, (*Mém. de l' Acad. de Toulouse*, t. III., 1788,) cites two similar cases, in one of which it was the first phalanx, and in the other the second. The same thing took place in the thumb of one of my best friends, and one of the first physicians of France. The first phalanx of his left thumb, diseased for more than a year, in consequence of a wound, necrosed throughout its whole extent and surrounded with a sheath in full suppuration, admitted of being extracted through an ulcerous opening, (trajet) which required only to be a little enlarged; the finger thus treated, partially recovered its functions. M. Heine, (*Gaz. Méd.*, 1834, p. 644,) also states that he has removed the middle portion of a first phalanx, by means of his osteotome; and M. Sanson, (*Thèse de Concours*, 1833,) has seen the first metacarpal bone reproduced after having been destroyed by necrosis.

B. *Bones of the Metacarpus*.—In treating of amputation of the fingers and of the hand, I have already spoken of some exsections of the bones of the metacarpus, and I shall speak of them again further on. I will add in this place, that if the extent of the evil permits, we ought to exsect only the body of the bone, and do all in our power to save the extremities. Attacked upon the radial side of its dorsal surface, the metacarpal bone of the thumb could be as easily excised with Liston's pliers, or Rambaud's saw, as it could be disarticulated by the method which I have elsewhere spoken of, (vid. supra, under Amputations,) or by that which I shall soon mention. The same could be said of each of the other bones of the metacarpus; all of them might be laid bare separately on their dorsal surface by a long incision, and divided near their head with the instrument I have just mentioned. The tendons pushed to one side or the other during the operation, could be easily avoided, so as to be enabled afterwards to resume their functions.

Besides that this operation, which was already recommended by M. Champion, in 1815, is more easy and infinitely less serious than disarticulation, it would have also the advantage, the osseous epiphyyses being preserved, of rendering the re-establishment of an osteo-form (osteiforme,) cicatrix less difficult, and of presenting many more chances of retaining the form and primitive functions of the corresponding finger. It would be an easy matter for me, were I disposed to analyse the cases where amputation of the bones of the metacarpus with disarticulation of one or both their two extremities has been performed, whether the finger corresponding has been preserved or carried away at the same stroke, to show that it would have been possible in many of these cases to have restricted ourselves to the simple excision of the part diseased.

§ II.—*The Fore-arm.*

When the body of the bones of the fore-arm is carious, or necrosed or degenerated, it may seem impossible to cure the disease without amputation. I have to reproach myself with having amputated the arm of a man, whose fore-arm swollen and perforated (*criblé*) with fistulous passages for many years, had nevertheless, for its fundamental lesion, no other than fragments of necrosed bone, which were completely isolated in the centre of the ulna, and which it might have been *possible* to have removed by exsection. The same thing happened to me with a scirrhus affection which was situated in the body of the radius, and which at the present day probably I would have destroyed, while preserving to the patient his hand.

A. *Ulna*.—Sculetus, (*Arsenal de Chir.*, tabl. 28, p. 83,) in order to remove an invaginated necrosis of the ulna, made an incision from the carpus to the elbow, and Pezoldi, (*Obs. Med.-Chir.*, p. 126,) relates that Fr. C. D'Arinbruste, had successfully extracted twenty portions of this bone from a student affected with *spina ventosa*. In a case of caries, Roland, (*Bonet*, t. IV., p. 116,) succeeded by rasping the bone daily; and M. Baudens, (*Gaz. Méd.*, 1838, p. 415,) in a case of gun-shot wound has removed four inches of this bone. It appears also, that the middle portion of the ulna had already been exsected, during the last century by a surgeon who was an acquaintance of Orred. (*Bull. des Sc. Méd. de Bologne; Journ. des Connaiss. Méd.*, 1834, t. II., p. 201.) A soldier who had lost a considerable portion of the ulna, and whose case was mentioned by Dupuytren to M. Champion, (*Thèse No. 11*, Paris, 1815, p. 57,) was not maimed by it; and the exsection of this bone appears also to have been performed by M. Withusen, (*Jæger, Op. cit.*, p. 20,) and by M. Werr, (communicated by M. Sprengler, in 1838.)

Three conditions may be presented here, as in almost all the long bones; sometimes the disease is situated upon the surface of the bone, and does not include its entire thickness; sometimes a sequestrum has been formed in the centre of a new bone, as if in a sheath or long cavern; finally it may happen that the bone is diseased throughout the whole thickness of its cylinder.

In the first case, we incise all the soft parts upon the superficial surface of the bone, above and below, and to an extent which goes an inch beyond the limits of the disease. After having properly isolated the part to be cut out, we make use of the crested saw, or that in the shape of a mushroom, or with a flat disc, in such manner as to preserve as much of the thickness of the bone as possible, while leaving none of the disease behind. The gouge, mallet, and rasp may also be of service in these cases.

In the second condition, we must also incise extensively. Upon the supposition that ulcers penetrate to the necrosis, and that this latter does not appear to be very extensive, we then limit ourselves

to enlarging the opening. Then seizing the fragment with a good pair of scissors, we sometimes succeed in extracting it without any further difficulty. In the contrary case, we are obliged to remove a greater or less portion of the osseous sheath which encases the sequestrum. If this sheath has only one opening, we may enlarge it by means of the concave rowel-saws. If it is confined by a sort of bridge, a cut of the crested saw on each side will enable us to extract the sequestrum afterwards by a stroke of the chisel. We could effect the same object by introducing under it, by means of a flexible and curved probe, the chain-saw of Aitken. Entering by one aperture, and coming out at the other, this saw would thus divide the osseous substance from within outwards, and first on one side and then on the other, with the greatest degree of facility. The chisel and gouge, and even the trephine, might also here be of service. But a strong pair of forceps, and either the crested, rowel, or articulated saw, or the osteotome of M. Heine, would scarcely permit us to feel the want of any other instruments. The canal which encloses the necrosed sequestrum, in such cases, and which is ordinarily very large, when once liberated from the former, contracts and heals without difficulty. But we should err, in attempting to close it by immediate union. It is one of those wounds which must suppurate, which are to be dressed from the bottom, (à nu,) and filled daily with small balls of lint.

I. *Olecranon*.—I have never had occasion to perform exsection upon the lower extremity of the ulna; but I have seen many patients whose olecranon should have been excised, and might have been so operated upon with advantage, if the patients themselves had consented to it, or the surgeon had decided upon it. I once performed this exsection on a young girl, who recovered perfectly; a necrosis accompanied with caries existed on the projecting point of the elbow; every thing had been made trial of for the space of eighteen months, and several physicians had expressed an opinion that the articulation was involved. Having made a crucial incision upon the soft parts, I laid bare the entire olecranon without any difficulty, taking care to avoid the ulnar nerve behind and the humero-radial articulation in front. Then bending the fore-arm, I was enabled with two cuts of the saw to excise a cuneiform fragment corresponding with the length of the olecranon, and thus to remove the whole of the diseased portion of bone. After the cure, the functions of the limb were performed as perfectly as before the disease. M. Textor (communicated by M. Sprengler) was equally fortunate with a patient upon whom he operated in the year 1836.

[EXSECTION OF THE OLECRANON.]

The *Exsection of the Olecranon*, as performed by Dr. G. Buck, at the New-York Hospital, Oct. 29th, 1842, (Vid. *The American Journal of Medical Science*, Philadelphia, April and July, 1843,) for hypertrophy of that process from the effects of a fall, and whereby flexion and extension of the fore-arm were abolished, though pro-

nation and supination remained nearly normal, is reprehended in unqualified terms by M. Guérin, (*Gaz. Méd. de Paris*, tome XII., 1844, p. 291,) as an uncalled for, and severe and dangerous operation, especially when the surgeon must have known that ankylosis is the very result we have to apprehend from such attempts, and which result was actually now permanently produced by the ablation in question; *i. e.*, a fixity of position was now given to the arm, when before it had considerable extent of motion, and gave no inconvenience whatever—assuredly a dearly-bought compensation, that should have deterred the operator from an experiment of this kind. It is a very different thing where a whole ankylosed, consolidated joint has been exsected, as has been frequently done at the knee, and recently [See our Vol. I.] most triumphantly achieved by Dr. Buck also at the New-York Hospital during the past year; the patient having recovered entirely, and being now enabled to rest himself on that leg, upon the metatarso-phalangeal articulations of the foot, which makes up for the shortening of the limb, caused by the abstraction of bone, and also corresponds to the slightly flexed position which the leg was purposely made to take by the shape which was given to the wedge or plate of bone exsected. See the complete details of this case at the end of this volume, as corrected by Dr. Buck for this edition of Velpeau's Surgery. T.]

II. *Body of the Bone.*—When the whole thickness of the bone is to be exsected, the operation becomes a little more serious. If the soft parts themselves are adherent and ulcerated, we must not hesitate to sacrifice some portions of them. The most convenient process here, consists in making two very long and slightly curved incisions, with their concavities facing each other, as in circumscribing an ellipse. The lips of these incisions are then dissected in front and behind as far as the radial border of the bone. The section of the bone may then be effected by means of the chain-saw, if it should be convenient to pass it around the bone by inserting it through the inter-osseal space. If the chain-saw cannot be used, and the ulna is somewhat voluminous where we wish to divide it, Liston's pliers may be of service. Otherwise we should make use of the vertical saw of M. Léguillou, the flat rowel of M. Martin, or either the crested or hand-saw. The soft parts will have to be carefully protected by compresses or pieces of wood or pasteboard; and we should generally commence on the most movable part of the bone. An elevator, or any resisting metallic plate slipped into the track of the saw, will complete the separation of the fragment we wish to remove, when it should appear to be difficult to effect this by means of the saw.

The excision of the ulna having been accomplished, we must now attend to the dressing with some degree of care. The immovable bandage with a long opening would in a case of this kind be particularly advantageous, since it would allow of the hand being maintained in a suitable position, would prevent the two fragments of exsected bone from approximating too near to that which

has been preserved, and at the same time enable us to dress the wound conveniently.

B. *The radius*.—What I have just said of the ulna applies equally well to the radius. The carpal extremity of this bone might be exsected like the olecranon without obliging us to penetrate into the articulation.

I. Exsection of the middle third of the radius has been performed by M. Baudens (*Gaz. Méd.*, 1838, p. 415) in cases of gun-shot wounds. M. Flameng (*Dissert. Inaug.*, &c., Utrecht, Juin, 1834) in Holland has also successfully exsected this bone in a state of necrosis. He made use of the chain-saw, which broke twice during the operation; a fibro-cartilaginous tissue ultimately replaced the part of the bone which had been removed. This soldier who was operated upon in 1826 did not die till the year 1832; and the dissection of the limb presented one of the most remarkable cases known. M. Saint-Hilaire (*Thèse*, Montpellier, 1814, p. 16) relates another remarkable example of this operation. The process in other respects is the same as for the extirpation of the radius itself.

II. *Extirpation*.—A necrosis with fungous degeneration of the periosteum which extended nearly throughout the whole length of the fore-arm, suggested to me in 1826 the idea of removing the radius which was alone affected, in place of amputating the arm; but the patient preferred the latter operation.

In the dead we may perform this operation without any difficulty, and without *absolutely* destroying any tendon or muscle. The fore-arm is to be placed in semi-flexion. An incision parallel to its axis first lays bare the outer and posterior side of the radius. The two lips of the wound are then held apart and separated by means of the bistoury from its anterior and posterior surfaces, a little below its middle portion, since the radius there lies in some measure naked under the integuments. We then endeavor to insert between its ulnar border and the soft parts a grooved sound,* which should serve as a conductor to the articulated (or chain) saw. With this last instrument we make the section of the bone, acting from within outwards; we then extirpate the two fragments in succession, dissecting them carefully from their free extremity to their articulation.

If there should be too much difficulty in pushing the integuments outwards, or that they should interfere with the introduction of the saw, there would be no impropriety in dividing to the extent of a few lines each of the borders of the first wound.

If an osteo-sarcoma, or any tumefaction whatever should occupy the bone in such manner as not to admit of our sawing at the middle part first, we should begin, after having completed the incision through the soft parts, by disarticulating the upper extremity first,

* Wherever a *grooved sound* (*sonde cannelée*) is mentioned in these volumes, it corresponds in function to the instrument which the English and American surgeons term a director. But as the author sometimes speaks specifically of a director or *conducteur*, we have preferred to give the phrase *sonde cannelée*, which appears in almost every one of the operations he describes, a literal translation. Its meaning is understood, and must not be confounded with the *sound* used in lithotomy, &c. The French call *cannelés*, *bougies*, *directors*, &c., all by the general name of *sonde* or sound. T.

in order to extirpate the bone from above downwards. The rest of the operation is to be conducted upon the same rules as for excision of the body of the radius. This operation of extirpation of the radius, moreover, has now received the sanction of experience. M. R. Butt (*Anat. Chir.*, American translation, by M. Sterling) of Virginia, performed it with perfect success on living man in 1825.

§ III.—*The Arm.*

Exsections of portions of the humerus external to the articulations of the arm, have frequently been performed. Moreau, (Champion, *Thèse*, &c., p. 53,) in this manner removed the whole continuity of the bone. According to Jæger, (*Op. cit.*, p. 19,) Lecat did the same. These exsections, like those of the fore-arm are of three kinds. That for invaginated necrosis, is the one that has been performed the most frequently. This necrosis, whether it be situated in the superior extremity or in the middle or inferior portion of the bone, must nevertheless be always attacked upon the outer side of the limb.

At the lower portion we may often remove it without opening into the articulation, or proceeding to amputation. A young peasant, who had his elbow fractured five years before, being exhausted by long continuance of pain, was admitted into the Hospital of La Charité in the beginning of 1838, for a necrosis, complicated with inflammation at the joint. The whole lower extremity of the humerus was greatly enlarged (*épaissié*) and swollen. I was enabled to ascertain with the probe that the centre of the disease was situated in the interior of the outer condyle (*epicondyle*). A crucial incision, carried an inch longer above than in the opposite direction, exposed the whole external condyle of the humerus, which I then excised with the cutting pliers. A fragment of necrosis which was formed there in a boney sheath, (*caverne*—see *supra*) was extracted by means of a strong forceps. I then clipped off (*fis sauter*) the margin and inequalities of this cavity, by means of the chisel, a strong scalpel and the cutting pliers mentioned. This young man who had already been severely troubled for six weeks with a wandering erysipelas (*erysipèle ambulant*) was attacked with it again fifteen days after the operation, and died at the expiration of two months subsequently, in consequence of the eschars and sub-cutaneous purulent abscesses which appeared throughout every region of the body, and from a diarrhœa which nothing could check. The wound of the elbow, however, was in progress of cicatrization, and there remained nothing of the disease either in the humerus or arm, [*fore-arm.*] or about the elbow.

At the middle portion of the humerus the incisions should be made in the same manner as I have described for non-consolidated fractures. At this part I have frequently succeeded by making an incision of only two inches in length, in extracting from the centre of this bone by the aid of a strong dissecting forceps, necrosed portions from two to three inches long, and thus have

been enabled in the course of three weeks or a month, to effect cures in patients who had been from eight to ten years the prey to inflammations, abscesses or fistulas.

The operative process will vary here as in exsection of the bones of the fore-arm, and is to be regulated by the same rules.

In its upper third, the humerus affected with necrosis, can only be reached through the deltoid muscle. I have found an advantage in that part in cutting out a semilunar flap, with its free border outwards and backwards. Raising up this flap as a kind of covercle, and which contains within it the fistulous passages with which its tissues may be perforated, we are enabled to lay bare with ease all the projecting portion of the bone. Operating in this manner upon a youth whose arm had been diseased for six years, I exsected the bone by means of the saw, carried from above downwards, and parallel to the axis of the arm, first near the root of the flap, and afterwards near the posterior lip of the wound. These two cuts of the saw, which went to join each other at their extremity, circumscribed an operculum which I afterwards detached by means of a chisel. The osseous cavity being thus completely laid open, exposed to view the necrosed cylinder, which was seized hold of, and extracted without difficulty. Having cleansed it of the fungosities and necrosed fragments which remained in it, I had nothing more to do than to allow the semilunar flap of soft parts to fall down upon it, and to treat it with simple dressings. No accident supervened, and the young man got perfectly well.

Enormous portions of the humerus may be in this manner extracted. The arms, in the patient Schmid, (*Journ. de Méd.*, 1686, p. 56-58,) furnish a proof of this; Ruland gives another example, (Bonet, t. IV., p. 140;) and Walker, (*Gaz. Sal.*, 1776, No. 31,) Weidmann, Amyaud, (*Abrégé des Trans.*, trad. de Pinel, p. 324,) Schaack, (Mursinna, *Journ. de Chir.*, t. I., p. 195,) Middleton, (*Trans. Philosoph.*, abrégé par Pinel, p. 321,) M. Champion and Simonin (communicated by M. Champion,) relate analogous cases. To the remarkable examples of this kind which are given in the *Memoires de l'Académie*, and to those which occurred in the practice of Dupuytren, and which I myself saw at the Hôtel Dieu, may be added the following: A young vine-dresser, aged fifteen years, had in consequence of measles a necrosis in the humerus, for which nothing was done for the space of near two years. M. Antheaume, a surgeon of Tours, seizing the necrosed fragment with an ordinary forceps, extracted it, and found that it comprised the whole upper and middle third of the humerus. Notwithstanding this enormous loss of substance, the arm gradually re-acquired its original strength, and enabled the young man to occupy himself without any inconvenience with the laborious occupations of husbandry, (*Société Méd. de Tours*, 1817, 2e trim., p. 14.)

[FALSE JOINTS AT THE SHOULDER.—These may present cases for exsection. Mr. A. Snee (*Lond. Lanc.*, March 22, 1845) describes a remarkable case accidentally found on inspecting a subject, in which

the great tubercle of the dislocated humerus had become invested with a false capsule by condensation of the cellular tissue under the deltoid, and the surface of the tubercle smoothed down and articulating with a corresponding smooth surface on the edge and under part of the acromion, the latter articulating surface being increased in extent by a deposition of bone extending half an inch nearly into the tendon of the deltoid. The great tubercle having become converted into an articulating surface, the attachments of the tendons of the supra-spinatus and infra-spinatus were, as was anticipated, found wanting, which with the fact of a piece of bone still being left attached to the ruptured margins of the tendons, proved that the tubercle must have suffered in the injury. The parts thus torn left a gap through which the normal and abnormal joints freely communicated. The long head of the biceps was also ruptured and formed a new attachment to the biceptal groove below; yet notwithstanding the head of the humerus glided freely in the glenoid cavity, and both cavity and head were perfectly normal.

An important pathological fact was thus established relative to the influence of the spinati and tendon of the biceps on the position of the joint. Hence, on the division of the muscles named, the humerus was drawn up to the acromion by the deltoid, and hence the contact of the tubercle with the acromion frayed out a new joint. But the head of the humerus being only partially removed from its position, Mr. Smee terms the lesion an incomplete dislocation upwards. There were in fact two joints or a double joint, giving to this compound and more extended articulation a character analogous to the articulation of the hip joint. There was also a fracture of the clavicle on the same side which had united. The facts of this case with another by Mr. Soden, in which the tendon of the biceps only was ruptured, (*See Medical and Chirurgical Transact.*) prove that the tendon of the biceps alone or in great part can keep the head of the bone in its position.

In the treatment, therefore, of such dislocations, he proposes to relax the spinati, deltoid, and long head of the biceps, by keeping the arm behind the head in such manner that the fingers touch the opposite shoulder. This would not do, however, if the clavicle were also fractured. Four cases of dislocations of the shoulder-joint, recorded by Mr. A. Cooper, all differ radically from this extraordinary case of Mr. Smee. A case, however, more similar to Mr. Smee's, is related by Mr. Potter, (*London Lancet*, May 17, 1845,) in which however only the capsular ligament and long tendon of the biceps were ruptured, so that the upper and outer part of the head of the humerus articulated upon a bursa under the acromion. The tendons of the spinati were torn, but by their connection with the teres minor were still partially attached to the neck of the humerus.

Mr. Potter, in commenting on Mr. Smee's case, differs somewhat from his conclusions, and also states that there are in the University College (London) *six* specimens in which *porcelaneous* deposits are found on the acromion in false articulations with that process. A

case in which there was a rent of the capsule is described recently (*Dublin Journal of Medical Science*, Vol. III.) by Sir Philip Cramp-ton, and five dislocations are recorded by Mr. Smith (*Medical Gazette*, London, Vol. XIV.) in which the long tendon of the biceps was ruptured, and in four of which the appearances described above on the acromion were noticed. Mr. Potter considers that in Mr. Smee's case the dislocation was not only upwards but *for-wards*. The spinati and the sub-scapularis were all torn also in a case by Mr. Curling, (See Sir A. Cooper on Dislocation, last edition, p. 385.)

The formation of a False Joint in Luxations and Fractures of the Neck of the Humerus.—The difficulties which attend the reduction of dislocations of the head of the humerus, complicated with fracture of its surgical neck, do not in our opinion warrant us in desisting from continued and timely efforts to reduce the parts to their normal position. Above all they do not in the opinion of M. Guérin, (See his *Gaz. Méd.*, Avril 26, 1845, p. 270; also *Gaz. Méd.*, 1843, p. 496,) justify the late practice advocated by MM. Riberi and Peyrani, of attempting to form a false joint (pseudarthrose) at the humero-scapular articulation, (See *Giornale delle Scienze Mediche*, &c., Torino, 1844-45; also, *Gaz. Méd. de Paris*, 1843, p. 496, and 1845, p. 270, as cited;) which he deems a severe and dangerous experiment, by the pain and inflammation the repeated forced exercise of the upper extremity necessarily produce, and the dangers which may thereby result, as abscess, gangrene, tetanus, &c. T.]

§ IV.—*The Clavicle.*

The body of the clavicle, which is frequently affected with exostosis, caries, and syphilitic necrosis, is also very liable to critical and scorbutic necrosis, as in the case of Angerville, (Chopart, *De Necrosi Ossium*, 1776,) and also to sarcomatous degenerescence. Its relations with the chest and especially with the subclavian vessels, and the little opportunity (prise) it offers for instruments, had at first placed it altogether out of the pale of surgical operations, (en avaient d'abord éloigné toute tentative chirurgicale.) Even supposing that the idea of removing the middle portion of the clavicle had suggested itself to the minds of surgeons, it would have been soon also renounced from the fear of destroying at the same time the functions of the arm. At the present day these apprehensions have been put to rest. Kulm (*Thèse de Waller*, trad. Franç.) had already mentioned the case of a man in whom exsection was performed upon the clavicle for an osteo-sarcoma, weighing five pounds, and which patient got perfectly well without losing the use of his arm. Meyer (Rougemont, *Bibl. Chir. du Nord*, t. I.) relates the case of a young person in whom the whole continuity of the clavicle in a state of necrosis was extracted without leaving any infirmity. The same thing occurred in the patient of Otto, (*Gaz. de Méd. Nation. pour l'Allem.*, 1778, No. 46,) and more strikingly still in the one mentioned by Pezoldi, (*Obs. Méd. Chir.*, p. 126, 1715.) The case of a

child is also given who in consequence of small-pox lost one of its clavicles *entire*, without however impairing any of the functions of the corresponding arm [!]. The case given of M. Gilgencrantes (*Journ. des Progrès*, t. III., p. 240) in which he extracted more than three inches of the clavicle; the facts mentioned by M. Coulon, (*Thèse citée*, 1833, p. 29;) the operations performed by MM. Mott, Warren, (communicated by the author,) and Travers, of which I shall speak farther on, have moreover shown that the clavicle may be exsected or even extirpated in its totality with success.

Operative Process.—Whether the disease be a necrosis or an osteo-sarcoma, the body of the clavicle should be attacked always upon its antero-superior region. Where there is necrosis there will necessarily be some ulcers and fistulas. After having divided the integuments which separate these passages, or enlarged the only one that exists, we shall be enabled to ascertain if it will be advisable to treat the perforations in the new bone in the same way, [*i. e.*, by dilating them—see above. T.]; if the openings in this latter are not arranged in such manner as to admit of the issue of the diseased fragments, we proceed to the employment of the crested or rowel saw, and a strong scalpel, and the gouge and mallet, in the manner I have already described in speaking of exsections of the humerus. The species of table (*plafond*) which constitutes the anterior portion of the bone, may in this manner be exsected entire, when any necrosed parts whatever that exist may be then readily extracted. Upon the supposition, however, that the sequestrum reached to a great extent towards the acromion or sternum, we might then be placed under the necessity of breaking it in order afterwards to extract the two portions successively.

This kind of exsection is not difficult, nor is it very dangerous; the continuity of the bone moreover remains intact, and the portion left upon the postero-inferior region, always suffices for the reconstruction of the whole. When on the contrary the disease is of a cancerous character, and it becomes necessary to exsect the whole thickness of the clavicle, the operation becomes exceedingly delicate and dangerous—(*l'opération devient au contraire excessivement délicate et dangereuse.*) [We give the author's own words, because ignorant or envious persons, who generally presume the most, have in some places endeavored to decry this operation as trivial—seeing that they do not come in for a share of the honors. The author, it will be perceived, forcibly portrays the danger of these exsections. T.] It is in this operation where there is no moment at which each stroke of the bistoury may not incur the risk of admitting air into the veins; where no tissue can be divided without exposing to the danger of wounding enormous veins or voluminous arteries; it is here also that suppuration may be effused into the chest with the greatest degree of facility, leading to consequences which may prove speedily mortal; therefore in this operation we must circumscribe an ellipse of greater or less breadth upon the integuments and in front of the tumor, taking care to prolong the angles of this ellipse, very far in the direction of the acromion and

sternum. Dissecting afterwards each lip of the wound, the upper one to the neck, and the lower one to near the first rib, we effect the isolation of the bone upon sound parts on its inner as well as outer extremity (*en dedans et en dehors.*) This being accomplished, I would recommend that we should with the aid of the bistoury graze the inferior and then the superior surface of the bone on the outer side (*en dehors*) of the tumor, in order to introduce the chain saw and to effect the section in that part before proceeding any farther. The same thing should be done on the sternal side, if the thickness of the tissues should not render the coming down upon the clavicle in this direction a matter of too great difficulty. Then grasping the tumor itself in order to raise it up while drawing it towards us, we should dissect carefully from below upwards and from before backwards, or from without inwards, never losing sight of the neighborhood of the subclavian vein and even that of the internal jugular. As the operation may be long it will be necessary to tie in succession all the arteries.

The removal of the tumor being effected, I would fill up the bottom of the wound with small balls of lint, after which I should bring the borders of the wound slightly together, and not place them definitively into actual contact until after the expiration of eight or ten days.

[EXSECTION OF THE CLAVICLE.]

Mr. Liston, of London, (See his *Surgical Lectures—London Lancet*, Dec. 21, 1844, p. 361,) would appear to make rather light of the idea of any thing very formidable being attached to the exsection even of the entire clavicle. It is to be noted, however, that Dr. Mott, in his lectures teaches, and has ever taught, that this operation, which is another of those in surgery first performed by him, (see end of this volume,) that he deems it, so far as the manual is concerned, one of the most dangerous and difficult, if not *the most so*, of any to which the human body has ever been subjected, not excepting that of the ligature upon the *arteria innominata*; an unwavering adherence to which opinion, deliberately formed, Dr. Mott would, with all due deference to the judgment of others, take occasion to reiterate in this work.

It is unnecessary to recapitulate what is familiar to all, the extent of vital parts immediately interested with or actually attached, it may be said, to this bone throughout its whole length.

What facilities Mr. Liston may derive from a species of screw-lever to be inserted into the bone after disarticulating or making the section of one extremity, to hold up the diseased mass, Dr. Mott never having used it, cannot say; but no doubt it may be serviceable, as well as the *small copper* spatulas to hold the parts well asunder while dissecting the bone, and which Mr. Liston says he has found immensely useful.

But nothing, as it appears to us, can justify (if his lectures be correctly reported,) the degagée manner in which he speaks of this

operation when he says, (*Ib.*, *Loc. cit.*, p. 361.) “It (*i. e.* the operation of removing the clavicle for what he calls fibro-cartilaginous tumors,) is attended *with some little difficulty*; there are very important parts under it; but by dissecting close upon the bone and tumor, you *avoid the nerves and vessels*”!

We trust no young surgeon will be induced by the *cheapness* which the London professor’s language would seem to attach to this operation, and which to him perhaps may not be formidable, to undertake hap-hazard or thoughtlessly to carry his knife into such a region without some little surgical experience and anatomical knowledge at least, though aided by ever so powerful an array of adjunct mechanical implements.

Mr. Liston considers that in osteo-sarcomatous and *soft* tumors of the clavicle, especially if the glands are affected in the latter, the exsection of the bone is not to be meddled with. In fibro-cartilaginous tumors he would remove it, and has removed it as he informs us. T.]

§ V.—*The Scapula.*

The scapula may, like the clavicle, be affected with necrosis and sarcomatous degenerescence; but it is surrounded by such thick muscles that its exsection would seem at first to be a difficult matter. Certain facts, however, prove that this operation is not impossible. M. Janson, for example, effected the removal of a great portion of the scapula without touching either the shoulder or the chest; so also did M. Luke. It is also said that Jæger (Coulomb, *Op. cit.*, p. 29—30,) who himself ascribes operations of this kind to MM. Liston, Haymann and Syme, (Jæger, *Opérat. Résect.*, etc., p. 16,) has successfully exsected the spine and almost the entire body of the scapula, in a young girl, upon whom M. Textor had previously performed amputation of the arm.

A. *Exsection* here also presents a number of modifications: we may have to remove only one of the angles or the spine of the scapula, or it may become necessary to exsect the greater portion of this bone. To cut down upon the inferior angle, as Sommeiller did it, in 1796, (Champion, *Thèse*, etc., p. 47,) the better plan would be to incise liberally through the corresponding region of the integuments and latissimus dorsi muscle. Being properly denuded, the bone could then be readily excised with the common, or crested or chain saw, or M. Liston’s cutting pliers.

B. The *superior angle* would also require a transverse incision, which would involve a portion of the trapezius and levator anguli scapulæ muscles; the same instruments would also be required for the section of the bone. As to the *spine itself* of the scapula, the inner half of which was exsected by M. Champion, we should in order to cut down to it, begin with an incision which should follow the entire length of the spine and enable us to isolate the supraspinatus muscle above, and the infra-spinatus below. M. Liston’s cutting pliers, or the ordinary cutting forceps, or the con-

cave rowel saw, would then be more suitable than any other instruments.

C. If the *body* of the scapula should be diseased as in the case of M. Jæger, or that of M. Castara, (communicated by the author, December, 1838,) we should obtain some facility in exsecting it, in laying it bare by means of three principal incisions, one over the whole length of the spine, and the two others setting out from the anterior extremity of this prominence, to be prolonged to the root of the neck in one direction, and to the hollow of the axilla in the other. The soft parts which cover the supra-spinatous and infra-spinatous fossæ, should afterwards be turned back above and below, under the form of a triangular flap for each. After having sawed through the root of the acromion, and detached the whole circumference anteriorly and posteriorly, and then reversed from within outwards the body of the scapula, we could in turn, make the exsection of this latter, near the glenoid cavity, either by means of the chain saw glided underneath, or by the small hand-saw. We should in such a case be obliged to divide the common scapulary and supra-scapulary arteries. The sac formed by the wound would be easily diminished by the approximation of the flaps, but we ought not to attempt the complete closure of the wound until after the expiration of eight or ten days.

[EXSECTION OF THE HUMERO-SCAPULAR AND HUMERO-CUBITAL ARTICULATIONS.

Mr. Liston, (*London Lancet*, Feb. 8, 1845, p. 145,) as well as Mr. Syme are frequently in the habit of *disarticulating and exsecting both the shoulder and elbow-joints*. Mr. Liston very properly cautions against these operations, where the articular extremities are not diseased, as in sound joints it is a painful and difficult process, as well as of doubtful efficacy. At the shoulder, he recommends the operation as one that will immediately dry up and cure those distressing fistulous abscesses in this part, and which we have ourselves also frequently met with, burrowing deep and in great number, and opening externally in the thick muscular cushions around this joint from caries of the head of the humerus, &c., causing hectic, &c., and very frequently produced by mercurial drugging in syphilis. M. Liston here makes his incision near the posterior border of the deltoid quite down to the joint—then carrying the arm across the chest and pushing it up, you get to the neck and exsect it with the saw, or in young subjects with his pliers. You must take off also diseased portions of the scapula, if necessary, and do it with the *cross-cutting pliers*. Though the patient will not be able to use his arm above the head, he will still have all the motions of his arm and fore-arm. At the elbow the principal thing to avoid is the wounding of the ulnar nerve, which you accomplish by making your incision along its radial border, by which you are enabled to turn the nerve over the condyle out of your way. In denuding the articulating extremities you must be careful always to cut towards

them, as you thus save the muscles, tendons, vessels and nerves. In young subjects the pliers are quite sufficient, and in them there will be more motions preserved to the joint. After the operation you put the bones of the fore-arm at right angles with the humerus and in a state betwixt supination and pronation.

It appears that the *excision of the elbow-joint* was not performed for the first time in Great Britain by Mr. Syme, in 1829, as he thinks (see *supra*.) but by Mr. Josiah Stansfield, at the Leeds General Infirmary in England, in the year 1817 or 1818. (See Braithwaite's *Retrospect*, Part X., Art. 59, and Part XI., 1845, p. 115. T.)

ARTICLE XIII.—THE PELVIC EXTREMITIES.

§ I.—*The Foot.*

Exsection of the body of the bones, is felt to be much less necessary for the foot than for the hand; it is for example useless to think of it for the phalanges of the toes; on the bones of the metatarsus, however, it might be performed with advantage, if their middle portion alone should be affected; also in such cases where at the present day disarticulation would be performed. Having elsewhere stated what has been done for the metacarpal bone of the great toe, I shall not return to that subject at present; I will only add that Heister, (*Institut. de Chir.*, liv. V., chap. 9.) had already excised its middle portion, and that the four other metatarsal bones could readily be exsected in the same manner. A longitudinal incision either of the simple or elliptical form, would enable us to isolate their dorsal surface and two sides in such a manner, as to admit of their exsection at a single stroke first in front, and then behind by means of M. Liston's pliers, or one of the small flat rowel saws of M. Martin, or the osteotome of M. Heine, though the chain saw would enable us to do it equally well.

As it is next to impossible to exsect the cuboid, scaphoid, or cuneiform bones, without implicating the articulations, I will refer to the article on *Partial Amputations of the Foot*, or the *Exsection of the Joints*, [vid. both *supra*,] for what relates to exsection of the body of the bones of the tarsus.

§ II.—*Os Calcis.*

There is in the foot, however, a bone which under this point of view, constitutes an exception; I mean the os calcis. This bone which is very liable to caries and necrosis, and which makes a projection beyond and in a manner altogether distinct from the others, in the form of a posterior appendage, is as favorably situated for exsection as the long bones. Whether the heel therefore be affected with caries, necrosis, or osteo-sarcomatous degenerescence, provided the disease be altogether local, the surgeon ought not to think either of amputation of the leg, nor even of removal of the

foot ; exsection of the os calcis alone will be sufficient to cure the patient.

Science possesses numerous and various examples of this. Formey, (Rivière, *Obs. communiquées*, Obs. 3, p. 626, in 8vo.) or Formio (Samuel,) says that a ball existed for seven years in the os calcis where it was deeply embedded, (engagée,) and that he succeeded in extracting it by means of the trephine. In a similar case Morand (*Opusculs de Chirurgie*, partie 2, p. 248,) could not extract the ball, except by embracing it in the circle of the crown of the instrument. Moublet, (*Anc. Journ. de Méd.*, t. XV., p. 548,) having made extensive incisions, in order to lay bare the bone of the heel, removed by means of the chisel every thing which appeared to be rotten, (vermoulu) and afterwards applied the actual cautery three times. The cure succeeded to the exfoliation. Hey, (*Practical Observations on Surgery*, p. 37,) removed a considerable portion of this bone without wounding the tendo Achillis : the patient after the cure could walk with the same facility as before. Hey, (*Ibid.*, *Ibid.*) adds that the same treatment had been pursued in many cases admitted into the Hospital of Leeds. This author mentions another fact which ought to be noticed. In a case which he attended, the wound had been stationary for many years. Suspecting that this condition of things depended upon some disease of the bone, though he could perceive no evidence of degeneration in the soft parts, he detached the integuments from the subjacent bone, and removed by means of the chisel a very thin osseous lamina, though this also presented no appearance of degeneration, after which the patient got completely well.

Briot (*Hist. Milit. Chir.*, p. 187, 1818) saw *more than two thirds* of the os calcis removed in a soldier, who, in order to walk with ease, required nothing afterwards but a high heel to his boot ; and Dupuytren announced, in one of his lectures in 1816, that he had seen the os calcis in an infant reproduced entire. M. Champion (communicated by the Author, 1838) removed from a child, aged eight years, an internal sequestrum from the os calcis, of the size of the little phalanx of the thumb of an adult.

I myself have performed this operation *six times*, without ever having seen it give rise to any serious consequences. In the same way as for the humerus, I lay bare the bone by cutting a large semi-lunar flap from the soft parts, in such manner that the convex border of this flap is turned towards the front, or behind, or above, or below, according as the disease requires that we should cut down to it in one direction rather than another. This flap being raised up and folded back upon its root, enables us to apply upon the bone either the crested or the small common saw, or the flat or concave rowel saw, the gouge, mallet, sickle-shaped scalpel, or even the actual cautery or trephine. The operation being terminated, the flap naturally falls of itself upon the wound, and is generally more favorable to regular cicatrization than the crucial incision.

In two patients, who had on the under surface of the os calcis a necrosis of the size of a nut, I placed the free border of the flap

backwards, and found it easy to remove the entire projecting portion of bone by means of the small common saw, directed from above downwards and from behind forwards. In another case, I deemed it proper to place the border of the flap forwards, and directed the saw from below upwards and from before backwards, because the necrosis was situated immediately under the insertion of the tendo Achillis. In a woman, upon whom I operated at the hospital of La Pitié in 1833, the necrosis occupied the outer side of the os calcis, near its under surface; I raised the flap from below upwards and from within outwards. Being obliged, on the contrary, to destroy a similar disease on the inner border of the os calcis in a child aged six years, upon whom I operated at La Charité in 1838, I turned the convex border of the flap forwards and upwards, in order to be enabled to avoid with certainty the fibro-synovial sheath which lies behind the internal malleolus. I adopted the same course, in October, 1838, in a patient of M. Barrette, in whom it became necessary to remove the outer half of the right os calcis, which had been a long time carious.

If, however, the whole of the os calcis is to be removed, the crucial incision may be adopted. It is rare, however, that any other than degenerations of a bad character require this kind of exsection; the necrosis presenting itself almost always under the form of a fragment or nodule, (noyau,) imprisoned in the centre of a fistulous cavity, (caverne,) requires only that we should make an opening of sufficient size to extract it, and thus place the system in a situation to dry up the purulent discharge, (foyer.) The excision of the os calcis, which has been performed at Wurtzburg by M. Heine, (*Gaz. Méd.*, 1834, *Memoire citée*, p. 644;) at Paris by M. Roux (*Lancette Franç.*, t. II., p. 215) and by Dupuytren, (communicated by M. Champion, 1838,) who, in 1833, related four cases of this kind to M. Champion, has furnished every where favorable results.

The patients thus operated upon, have a heel which has a great tendency to become ulcerated and excoriated; but in other respects the functions of the foot are not disturbed.

[*Exsection of the Os Calcis.*—In cases where the *tuberosity* of the os calcis alone is affected, excision, says Mr. Syme, (Cormack's *Lond. & Edinb. Month. Journ.*, &c., Feb., 1843, p. 95,) may be executed completely and certainly; and it is sometimes, though rarely, possible to extirpate the disease, even when it extends to the articulation, either directly by gonging out the carious part, or by making a perforation through it across the foot, and passing a seton, which may be made the vehicle of suitable applications, such as the red oxyde of mercury, the mineral acids, or a saturated solution of the nitrate of mercury.

Exsection of the Astragalus.—M. Rognetta successfully extirpated the *astragalus* in a man who, in the terrific accident on the Versailles railway in May, 1842, had received a compound dislocation and fracture of this bone. What was remarkable, the limb, after recovery, retained its normal length, (Cormack, *Lond. & Ed. Month. Journ. of Med. Sc.*, Aug., 1843, p. 745.) T.]

§ III.—*The Leg.*

Next to the humerus, the bones of the leg present themselves for exsection; but it is rare that we ever operate upon more than one of these bones at once.

A. *Exsection of the Tibia.*—Up to the present time, exsection of the tibia has rarely been performed, except for necrosis or caries. In cases of osteo-sarcoma, or of spina ventosa, amputation would generally be preferable. Necrosis and caries of the tibia, moreover, are situated sometimes on the middle portion and sometimes on one of the extremities of this bone.

I. *The body of the tibia*, when its outer laminæ are in a state of necrosis, might easily be laid bare and excised with the crested or the rowel saws. The gouge and mallet, rasp, and chisel may also be employed here without any danger. For this operation, I am in the habit of making the incision into the soft parts, in such manner that the wound represents the arc of a great circle, (*grand arc de cercle*), with its convexity inwards, and then to dissect the flap from behind forwards, in order to turn it outwards. By this means we have full liberty to manipulate, with the saw or other instruments, from the inner towards the outer surface of the bone. The tegumentary flap thus cut out, may afterwards be easily brought down over the loss of substance. M. Heine says that his instrument has been employed in Germany six times in cases of this description, and M. Textor also used it in the years 1837 and 1838, on two patients who recovered. M. A. Séverin (*De Reconditâ Abscessum Nat.*, etc.) rasped the bone of the tibia at its middle portion for an abscess, and Scultetus (*Arsenal de Chir.*, Obs. 98, p. 130) cites a similar case, in which he had to make an incision into the parts, throughout the whole extent of the leg. A girl, in whom Benivenius (*Bonnet*, t. IV., p. 600, Obs. 88) excised a great portion of the tibia, got perfectly well. Lecat, (*Planq.*, *Bibl.*, t. XXIX., p. 129, in 12mo,) in the same manner, removed an enormous portion of the tibia in a putrid state, (*vermoulu*), and covered with exostoses. J. L. Petit, (*Malad. des Os*, t. II., p. 229,) Bromfield, and Vigaroux (*Œuvr. Chir.*, 1802, p. 102, 398) have also reported analogous cases. M. Ducasse (*Journ. Gén. de Méd.*, t. LIII., p. 149) saw M. Vivès extract, with success, a long sequestrum from the tibia; and M. Wathely (*Practical Observations on Necrosis, &c.*, 1815) was not less fortunate than M. Vivès. Cartier, (*Précis d'Obs. de Chir.*, p. 213,) who in this manner removed almost the *entire tibia*, found the new bone so soft that he was obliged to place it in a fracture apparatus.

David, (*Obs. sur la Nécrose*, 1782,) Viguerie, (*Acad. de Toulouse*, 1788, t. III., Obs. 1, 2, 5,) Dussaussoy, (*Gaz. Salut.*, 1786, No. 28,) Laumonier, (*Médec. Eclairée par les Sciences Phys.*, t. III., p. 155,) and Hall, (*Gaz. Salut.*, 1776, No. 37,) have also taken out very large portions of the tibia in a state of necrosis or caries. A sequestrum imprisoned in an ancient callus, was removed successfully in

one case by M. Champion (communicated by the author) and in another by M. Sauter, (*Instruct. sur les Fract.*, p. 72, pl. 3.) M. Champion succeeded also in the same manner in two other patients in whom there existed an imbedded necrosis, and similar facts are related by J. L. Petit, (*Œuvr. Chir.*, t. II., p. 31, 32.) Verguin, (*Journ. de Horne*, t. VII., p. 395,) and Cullerier.

Hey, (*Pract. Obs. in Surg.*, p. 26, 32, 34,) who operated on this bone the first and second time in 1792, and the third time in 1804, taking for his guide the caries, excised only the external laminæ of the tibia. The same course was pursued by M. Chapiotin, (*Thèse*, 1811, Champion, *Thèse*, p. 90,)* and Percy, and by MM. Graefe and Liston. (Jäger, *Opér. cit.*, p. 20.) Moreau, whose remarkable cases were collected and published by M. Champion, (*Thèse*, etc., p. 77, 79, 80, 82, 84,) performed partial excisions of the tibia six times, at different degrees of depth. Exsection through the whole thickness of the tibia in an old man, and afterwards upon a young man who lost in this manner an extent of four inches of the bone, was also successfully performed by this practitioner. (Champion, *Thèse*, p. 85, 86,) as it already had been also by Smith and Noble, in a man who died of small-pox six weeks afterwards. MM. A. Cooper, Siebold and Wickham, (Jäger, *Op. cit.*, p. 20,) also severally succeeded with partial excisions upon this bone in destroying an exostosis, spina ventosa and hydatids.

In cases of *invaginated necrosis* the entire body of the bone may be dead. There are numerous examples of the kind on record, and in which nearly the whole of the diaphysis of the tibia had to be extracted. Without referring to the observations mentioned farther back, or to those related by Weidmann, Bousselin (*Observ. sur la Nécrose*, Acad. Royale de Méd., Janvier, 1782,) Chopart, (*De Necrosi Ossium*, 1776,) and M. Champion, (*Thèse*, etc., Obs. 22, p. 90,) I will cite the case of a young girl, who, after a putrid fever, had the whole body of the tibia necrosed from one epiphysis to the other. The dead cylinder was removed, and M. Antheaume, the surgeon, showed it afterwards to M. Herpin, (*Constitution Méd. de Tours*, 1817, 2e trim., p. 14,) who relates the case and who states that this young lady was perfectly cured, so that she could dance and use all sorts of exercises as though she never had had any disease in the leg. M. Herpin mentions also the case of a soldier who, in consequence of a sabre-cut on the middle portion of the right tibia, was ultimately restored in the same way. The surgeon having divided the sequestrum into two portions, was thus enabled to extract them without difficulty, and cured his patient so perfectly that the latter no longer thought it necessary to ask for his retreat (*réforme*.)

This bone also is often diseased only in the centre, and in such manner as to present the necrosed fragments only under the form

* [This fact [says our author in a note] is one of the most curious; the patient, Nicolas Grégoire, whom M. Nève again saw in 1829, having overheard MM. Breton, Hennequin and Oulied, discussing the nature of his disease, undertook to operate upon himself in 1803. He was three days occupied in this manner with the saw, chisel and hammer!]

of splinters, or irregular sequestra. In the first case the probe strikes upon a sonorous, moveable body, and apparently of considerable volume. In the second case the instrument indicates rugosities and fungous or anfractuons surfaces, but nothing irregular. In either case it becomes necessary to lay bare the swollen region of the tibia in its whole extent. If the hyperostosis should be found to be not over three inches in length, we should, after having laid it bare, by raising up a semilunar flap of the integuments, remove its vault with the trephine or the concave rowel-saw. By this means we make a large opening into the cavern of the tibia, which is to be then freed of the fragments and fungosities it contains, or even cauterized with the red-hot iron should its interior be affected with caries.

When the necrosis is actually invaginated, the tumefaction of the bone is usually very extensive. The great flap which I have spoken of being reversed from within outwards, places the whole anterior surface of the tibia under the eyes of the surgeon. We then make use of the crested, the small chain or concave rowel saws, after which strokes upon the chisel, to evulse the osseous bridges and bridges which go from one fistula to another, and which obstruct the egress of the sequestrum to be removed.

This sequestrum being once brought into view, is easily removed if either of its extremities is free on a level with any part whatever of the breach we have made. In those cases where the two extremities towards the epiphyses, by being fastened (*encadrés*) there, do not admit of our loosening or extracting them, we should, after the manner of M. Herpin, break the sequestrum in its middle, in order to remove its two halves separately, by making tractions downwards upon the portion above, and upwards upon that below. To accomplish this, nothing more hardly is ever required than to insert the extremity of a spatula or a chisel or any solid lever whatever under the middle portion of the sequestrum, which latter is then to be raised up with some force by securing a point d'appui on the most solid part of the new bone. Dupuytren, however, found this in some cases so difficult that he got the manufacturer Charrière to construct a particular instrument for the purpose called *osteo-triteur* (or bone-crusher) a kind of *exfoliating* trephine, which however is in other respects sufficiently complicated. The necrosis being removed, we smooth down (*régulariser*) the borders of the cavity which contained it, fill it with boulettes of lint, and gently bring in front of it the raised-up flap of the integuments.

II. *The Lower Extremity* [of the tibia.]—Up to a late period, caries and necrosis of the internal malleolus, were treated only by exsection or amputation of the articular extremity of the tibia. A practitioner mentioned by Theden, (*Neue Bemerkungen und Erfahrungen*, etc., t. I., p. 73, ou t. II., 2e part.) let one of his patients die from having ventured to operate upon him in a different manner. Theden also gives two other examples of the same kind. In this point of view, practice has made considerable advances. If the disease is situated external to the articulation, the concave rowel-

saw of M. Martin enables us to remove it without destroying the continuity of the bone, and without opening into the neighboring synovial cavity, so that we substitute a simple operation, which is attended with but little danger, and which exposes the functions of the foot to no inconvenience, to one which is of a serious nature and one of the most delicate in surgery.

To perform this operation, I cut a semilunar flap, having its free border anteriorly, and which I reverse from before backwards, upon its posterior border, and upon the apex of the malleolus internus. This being done, I carefully denude the bone of its periosteum and of the lardaceous tissues which surround it. While an assistant holds the tegumentary flap, turned back towards the heel by means of a roll of linen, the surgeon adjusts and guides the cutting edge of the mushroom-shaped saw from the anterior to the posterior part of the malleolus, while at the same time a skilful assistant turns the shaft (*arbre*) of the instrument. Removing in this manner the bone layer by layer, we may excavate it deeply without danger, provided we avoid the articulation below and the fibro-synovial sheaths of the tendons behind. It is time to stop, however, as soon as the whole traumatic surface under the action of the saw presents a reddish tint and granular (*sablé*) appearance, with bloody points, (*pointillé sanguin*.) If some portions of this surface should continue yellow, and actually diseased to too great a depth, we should lay aside the rowel to attack them separately either with the trephine or chisel. I have performed this operation on the inner ankle only once; it was attended with no difficulty, and was followed by no serious accident; but the young man, though cured at first, was re-attacked some months afterwards, with caries of the radius, then of the pelvis, afterwards in the knee and same foot, and in this state returned to his home in the country. It would appear also that this operation has been performed once successfully with M. Heine's saw, (*Gaz. Méd. de Paris*, 1834, p. 644.)

III. *The Upper Extremity* [of the tibia].—The upper portion of this bone being spongy, thick, and very vascular, is frequently attacked with a complication (*mélange*) of caries and necrosis, either in its centre or on its surface. In a woman admitted into the hospital of St. Antoine, in 1828, for treatment of an enormous sub-patellar abscess, all that was found requisite was to cut down upon the integuments to the extent of three inches, in order to lay bare and remove a large necrosed lamina of the tibia. A young man who had had numerous abscesses in the upper part of his leg, had a necrosis there, situated so deep, that I was obliged in introducing the trephine, and afterwards the gouge, on a line with the spine of the tibia, to go from below upwards, and from before backwards, to within some lines of the articular cartilage, before I could thoroughly destroy it. In another patient, whom I operated upon, at the hospital of La Charité, in 1836, I was under the necessity of destroying, by means of the concave rowel-saw, a great portion of the inner surface of the tibia, and afterwards of excavating into this bone by means of the gouge to the extent of several inches, making

thereby a cavity large enough to hold more than one half the fist. None of these patients died, but they were a very long time in getting well; the last mentioned, who was admitted into Bicêtre, was amputated three years afterwards by M. P. Guersant.

The operative process, moreover, in these cases, is entirely subordinate to the degree, actual situation and form of the disease; so that we have sometimes occasion for the crucial incision, or the elliptical or simple incision, and also for every variety of saws and osteotomes.

B. *The Fibula*.—The body of the fibula, as it would seem, may be destroyed without any serious inconvenience to the functions either of the leg or foot. Desault, (*Jour. de Chir.*, t. IV., p. 254,) who proposed to excise in this manner an osteo-sarcoma, saw, it is said, a case, in which the loss of a great portion of this bone caused scarcely the slightest inconvenience in walking or standing.

Bourienne (*Journal de Médecine de Dehorne*, t. I., p. 215) speaks of a case, in which three fingers' breadth of the fibula was destroyed by a bullet, but which nevertheless recovered. The same result took place in a case cited by Gavard, (*Anc. Jour. de Méd.*, t. LXXIII., 1787,) in which a sixth part of the body of this bone was extracted, in consequence of fracture from a ball. Boyer (*Boyer, Malad. Chir.*, t. I., p. 241) also mentions a case of removal of the fibula by a ball in General Duch...., who however recovered.

I have elsewhere stated that Logan had exsected a portion of the fibula, in order to tie the posterior tibial artery. I will add also that Croxall, (*Annal. de Littér. Méd. Etrang.*, t. III., p. 375,) and Briot (*Essai sur les Tum. Artér.*, p. 135) imitated Logan or Gooch for other hemorrhages of the leg. Three inches of carious fistula were removed by Theden (*Progr. Ulter.*, etc., p. 157) in a patient, who died some time after without being cured. The one, however, from whom M. Ouvrard (*Mé debates*, etc., p. 157) excised only an inch, got well.

"We have," say Percy and Laurent, (*Dict. des Sc. Méd.*, etc.,) "a *fibula entire*, which we disarticulated above and below, in order to put a stop to an ulcerative state which occupied the whole outer surface of the left leg, and which had been produced and kept up by the almost general carious condition of this bone." We should state, however, that in a patient mentioned by M. Barbier du Bocage, this destruction of the fibula, though partial, was followed by a manifest inversion of the foot inwards. It is, however, satisfactorily established, at the present day, that the body of the fibula may be excised through its entire thickness, and in the greater extent of its length, without the foot thereby necessarily suffering any inconvenience. We shall see further on what Bécclard, M. Roux, and M. Scutin have obtained from this operation.

To remove in this manner the body of the fibula, a simple incision is required where there is only necrosis upon its periphery, (*nécrose périphérique*,) or an elliptical incision, in case of swelling or tumor, which incision should be made in such manner, as to admit of our laying bare the bone throughout the whole length of its ante-

ro-external region. After having detached from its anterior and posterior surfaces the peroneus longus, peroneus brevis, extensor longus digitorum pedis, and soleus muscles, we should have to divide it at the malleolus below, and at its small head above, either with the small chain-saw, the crested saw, directed very obliquely, or the flat rowel-saw. The separation of the rest of the mass could be made with promptitude, and without any farther difficulty. The peroneal artery alone, which is the only one that might be wounded, could most generally be avoided. But the dressing would require some precautions. It would be necessary that the immovable dressing should cover the entire inner side of the leg, so as to fix the foot and knee securely upon this side, without interfering with the daily dressing of the wound. A patient, in whom M. P. Guersant (*Jour. des Connaiss. Méd.-Chir.*, 1838, p. 189) excised a portion of the whole thickness of the fibula for ancient fungosities, recovered perfectly.

If the disease of the fibula was only an invaginated necrosis, it could be operated upon in the same manner as for that of the tibia. In a young man upon whom I operated in this manner, I made a long curved incision from the upper attachment of the peroneus longus muscle down to the root of the external malleolus, so as to circumscribe a long flap which was semilunar and convex posteriorly, and which I dissected from the outer border of the leg to the anterior inter-osseal fossa. To lay bare the cavity, I used the crested saw, and afterwards the gouge and mallet; but as a solid (pleine) portion of bone separated the two fragments of the necrosis, I was obliged to avoid this middle portion of it, and to extract these fragments, the one from above and the other from below. The narrowness of the canal, and the great distance between the osseous fistulas in this case, suggested to M. H. Larrey, who assisted me, the idea of a small, fine saw, bent to an angle near its handle, and with which it would be easy to saw through the vault or covercle of the necrosis, from the interior to the exterior, upon the supposition that a long, flexible probe would not allow of conducting the chain-saw from one fistula to the other, as under the arch of a bridge. Be that as it may, this young man who was attacked with an angioleucitis of quite a serious character, and afterwards with small-pox, ultimately got well, without having any actual weakness in his leg.

II. The *Inferior Extremity* (of the fibula.)—The external malleolus, like the internal, and in truth much more than that, is liable to caries and necrosis. So long as the disease does not penetrate through its whole thickness, and has not invaded the synovial cavity, it may be attacked like the preceding with the trephine, rowel saw, gouge and mallet. One of the patients operated upon by Theden (*Neue Bemerkungen*, etc., trad. Franç., p. 98, 99) died, but the other recovered. In performing this operation upon a man who had had a caries in the external malleolus for two years, I found it exceedingly easy. A semilunar flap, reversed from before backwards to the outer side of the heel with the precaution, un-

less the extent of the necrosis should require it, of not opening into the synovial sheath of the peroneal muscles, constitutes the first stage of the operation. We have then laid bare before us the whole extent of the external malleolus. With the concave rowel saw, directed by the surgeon, and the shaft turned by an assistant, we then remove successively from above downwards, and from before backwards, all the diseased laminæ of the bone, which may in this manner be scooped out (creuser) in form of a small cup (cupule) or saucer. There is no artery of any size to avoid, and the attention of the surgeon has only to be directed to the tibio-tarsal articulation, or the fibrous sheaths of the peronei muscles. In another case, I found a simple incision quite sufficient to enable me to remove with the forceps an isolated sequestrum from a necrosed malleolus.

[*Dislocation of the Astragalus, with fracture of the Fibula.*—This case is the more important because the leg was saved from amputation. Mr. Hancock, Surgeon to the Charing-Cross Hospital, in a valuable paper on the *Dislocation of the Astragalus, with the lower ends of the Tibia and Fibula inwards*, (*Lond. Lanc.*, Oct. 5, 1844, p. 35, et seq.) in which he shows that this accident, though rare, has not received the attention it merits, points out a part of the anatomy of this bone which he thinks has been overlooked: it is the *calcaneo-scaphoid* ligament, (ligamentum teres,) which is not a mere connecting medium, as considered, but enters largely into the formation of the astragalo-scaphoid joint, arising, as it does, from the lesser process of the os calcis, and spreading out like a fan to reach the upper and inner portion of the os naviculare. The cavity on the scaphoid bone being of itself too shallow to restrain the head of the astragalus in situ, if unaided, this ligament not only keeps it in proper position, but to a great degree sustains the constant stress made on the joint in walking, &c.; for in walking, &c., from the natural direction of the bone, the head of the astragalus inclines inwards as well as forwards, exerting more or less friction and pressure, according to circumstances, to counteract which this firm ligament is here placed, lined with synovial membrane, and in every way adapted to its office.

In a remarkable case of the luxation of the astragalus with fracture of the fibula, three inches above the ankle, the axis of the tibia, instead of falling on the centre of the foot, was thrown inwards and slightly forwards, giving the leg the appearance of being twisted in that direction. The position and direction of the foot were not materially altered, further than by its projecting considerably on its outer side, and the toes turning slightly outwards, but its dorsum looking upwards as in the natural condition. The anterior extremity of the os calcis at its union with the cuboid bone, could be distinctly felt, whilst above it was a considerable cavity instead of the prominence formed by the astragalus and external malleolus. There was also a cavity behind the posterior margin of the scaphoid bone; and on the inner side of the foot, a prominence corresponding to the internal malleolus, of which the inferior margin could be distinctly defined, and anteriorly and inferiorly

another projection more prominent, evidently caused by the head of the astragalus, over which the skin was tense, thin and vesicated. The distance between the internal malleolus and prominence of the os calcis was greater than in the sound foot, but not much, and that between the lower end of the inner malleolus and the sole of the foot much diminished, say to about an inch. The ankle-joint was still capable of flexion and extension, and there was very considerable motion in the centre of the foot, corresponding to the calcaneo-cuboidal articulation, forming, as it were, a double joint. The diagnosis of Mr. Hancock, therefore, was that the astragalus had been forced from without inwards, off the upper articulating surfaces of the os calcis, carrying with it the lower ends of the tibia and fibula, and most probably resting upon the lesser process of the os calcis.

To effect the reduction, an apparatus of straps and pulleys was used to draw the os calcis downwards and forwards, at the same time that the front of the foot was drawn downwards and backwards. Thinking it probable, after herculean and fruitless efforts of extension and counter-extension for a long time, that the neck of the astragalus had caught upon the inner edge of the scaphoid bone, the surgeon added to the forces employed, by directing some of his friends present to draw the foot also forwards towards the toes, while he grasped the tibia above the ankle, and drawing it backwards towards the heel, the bone almost immediately slipped into its place, and the natural line of the tibia and the positions of the foot were restored.

From the force and pressure used, the integuments over the joint sloughed on the third day after, exposing the bone naked in its proper position, and creating a considerable discharge. But the calcaneo-scaphoid ligament also sloughing away, the astragalus no longer restrained in that direction, gradually twisted round upon the os calcis, until at length a large portion of its head protruded through the opening in the integuments. The astragalus then becoming necrosed, the surgeon sawed off about three quarters of an inch of its head, when the wound gradually healed, and the patient left the hospital perfectly cured seven months after the accident. The surgeon saw the patient more than two years after, and found he had all the motions of his foot and joint perfectly, with the direction of the foot and malleoli natural.

Mr. Hancock could not derive from him how the accident happened. This surgeon supposes, however, that in his fall of thirty feet from a plank, he alighted on the inner edge of his heel, and immediately fell over on his right side and fractured his fibula, and that the calcis at this time, after the man had alighted and was again falling, received the whole shock, which, with the weight of the body, caused this bone to be thrown violently and obliquely upon the calcaneo-astragaloid joint, ripping up the inter-osseous ligament, and producing the displacement, which was also favored by the fracture of the fibula and natural direction of the upper articulating surfaces of the os calcis. Great laceration of most of

the ligaments of the parts immediately interested must, he thinks, have ensued.

From a review of this case, which he says is only the fifth one he could find on record, those of Sir A. Cooper, Professor Harrison, Dupuytren, and Mr. Howship, being the other four, the question has occurred, which, however, we would put with all deference to the surgeon who has so minutely and clearly described all its details, whether the severe and tedious efforts to reduce the parts, and the dangerous accidents thereby produced, would not have been all easily avoided and reduction readily effected by the mode now practised in supra-malleolar fractures, which are almost always accompanied with dislocation of the ankle-joint. We mean the *sub-cutaneous* division of the *tendo Achillis*, as that, from the difficulty of effecting the extension on the os calcis in the direction required, must have been a chief obstacle in the way. (See Vol. I.)

Where, however, from any cause whatever, the astragalus has not been reduced, and the parts are more or less consolidated, Mr. Guthrie, according to Mr. Hancock, has found immense advantage in two cases from a boot of a peculiar construction, (*London Lancet*, Oct. 12, 1844, p. 71,) which has, by a perseverance in the use of it, enabled the patient to re-acquire most of the motions of the joint required in walking, &c.; the pressure made having the effect in fact gradually to replace the bones in their natural position. T.]

§ IV.—*The Femur.*

A nobleman, of Verona, had on his thigh an enormous ulcer, which had affected the bone with caries to such extent that the medullary substance ran through the opening. The application of caustics and sarcotics, (sarcotiques,) had been had recourse to repeatedly. By means of a rasp I removed, (says Marchettis,) every portion of the bone in a carious state, until the blood oozed from the scraped surfaces. I then covered them with dry lint and applied sarcotics to the neighboring soft parts. In a few days after the bone was covered with granulations, (pullulations,) which sprouted from the neighboring parts or from the bone itself; and this was shortly followed by the cicatrix. (Marchettis, *Observ. Medico-Chirurg. rar. Syllog.*, p. 130, obs. 57, 1665.)

In November, 1781, David, (*Observ. sur la Nécrose*, p. 13,) extracted a portion of the femur seven inches in length, and which was completely encased in an osseous cylinder almost as hard as the primitive bone, and the walls of which had already acquired a thickness of 7 or 8 lines, though the disease had existed only 2 years. He detached for that purpose to the extent of about 10 inches in length by 4 to 5 in breadth, integuments, aponeuroses and muscles, in such manner as to lay bare the new cylinder, and to be enabled by means of the gouge and mallet to make an opening of sufficient size to extract the dead bone. The fever lasted but

twenty-four hours; no accidents ensued, and the cure was *almost* completed at the time David wrote.

“A child, aged fourteen years, says Vignerie, (*Mémoire de l'Acad. de Toulouse*, t. III., an 1788,) was admitted into the Hôtel Dieu, with the lower part of the right thigh double the size of the left; it was easily perceived that the tumefaction was osseous. At the lower part of this swelling there was an ulcer, through which the sound reached the dead bone at the depth of two inches. I laid it bare by means of caustic, and with the aid of the forceps extracted a cylindrical sequestrum of five inches in length. The osseous cavity from which I had removed it was still some days after sufficiently capacious to allow of its being replaced. M. Gardeil came to examine it. I was desirous in his presence of replacing the dead bone in the new one; he begged me to desist. The inspection of it, said he, is sufficient for me. He contemplated this process of nature with the satisfaction which a man of talent experiences when beholding such marvellous results.”

No one certainly would venture to remove the body of the femur affected with cancer or degeneration of a bad character. But like the tibia and humerus, this bone is frequently liable to different kinds of necrosis. Castel, (Champion, *Thèse* No. 11, Paris, 1815,) in the case of a soldier, adopted with success the plan of Marehettis. Bous-selin, (*Obs. sur la Nécrose*, obs. 4 and 8,) has seen a case in which almost the whole of the diaphysis of the femur was extracted without the patient being thereby rendered infirm. M. Champion, also, speaks of a man who it is said had lost a fragment of the femur four inches in length, whose thigh became shortened to the same extent, but who was ultimately enabled to walk. In the femur in fact as in every other bone, the sequestrum is not formed without a kind of new bone being developed in place of it as its substitute. Under this point of view we may extract without danger the largest description of necrosed portions of the thigh. The delicate part of this matter is that which relates to the operation. No part of the body of the femur is exposed and superficial like the tibia, or even like the humerus. Moreover, it is almost always upon the inside or posterior part of the thigh that abscesses and fistulas caused by the necrosis, find their exit; in which regions the number of the muscles, and the size and importance of the vessels and nerves, are naturally calculated to create in the mind of the surgeon the greatest degree of circumspection.

There are two modes of reaching these necroses in the thigh bone; one by election represented by the antero-external region of the limb, and the other that of necessity, indicated by the seat of the disease. However few openings, therefore, or however little attenuation of the laminae there may be on the convex portion of the femur, it is there nevertheless that we must endeavor to lay it bare to attack the disease. The curved incision and the semilunar flap of which I have already spoken would be of great advantage here. Raised up from without inwards and from behind forwards, they would allow of our laying bare the bone to a great extent. We

are then to make use of the different kinds of saws and scissors we have described in speaking of the tibia. The wound also is to be closed and dressed in the same manner. When the fistulas are immediately behind, the operation would be too dangerous and difficult to be undertaken, unless the sequestrum should, as it were, present itself of its own accord to the instruments. Suppose the disease should be outside of the sharp line (*ligne âpre*) of the femur, we might come down to it between the vastus externus and the biceps muscles. Provided there should be a chance of finding the diseased point upon the inner part of the thigh, we might also hazard the attempt of laying that part bare, by cutting down upon the posterior insertion of the vastus internus muscle.

A young girl who was afflicted for many years with a necrosis in the lower part of the femur, and who had had a great number of abscesses in this region, was received into the Hospital of La Charité in the month of July, 1838. Having ascertained that a voluminous sequestrum existed in the centre of the thigh bone, which was otherwise considerably hypertrophied, I made, at the distance of five fingers' breadth above the knee, an incision of four inches' length, which, in crossing the fibres of the vastus internus muscle, penetrated nearly down to the bone. A strong sickle-shaped scalpel, and a few strokes upon the chisel which was directed so as to act as a lever, enabled me to enlarge to sufficient extent the principal osseous fistula. Then seizing hold of the sequestrum with a strong pair of forceps, I ultimately succeeded in loosening it and extracting it entire, though it was nearly four inches long, and included nearly the whole thickness of the cylinder of the thigh at its lower extremity. One single ligature only was required, and simple dressings. The young girl had no accidents, and perfectly recovered.

II. *The Great Trochanter.*—The great trochanter, being separated from the common integuments externally by a bursa mucosa, and having on its posterior part between the tendon of the gluteus maximus and the neck of the femur, a small synovial sac, and being also the common point of insertion for most of the muscles of the pelvis or hip, is consequently exposed to the action of numerous causes of disease. From whence it happens that it frequently becomes the seat of caries and necrosis, and the source of abscesses and serious accidents. An adult man was attacked with pains, afterwards an enormous abscess and fistulas formed below the breech; three years of his life were dragged out in this manner, and he appeared to be on the point of sinking under the exhaustion produced. The thigh was taken off at the joint, when the great trochanter alone was found in a state of caries. A boy, fifteen years of age, had between the breech and the postero-external region of the thigh an enormous abscess, which was ascribed to disease in the bones of the pelvis or spine. The examination of the dead body proved that the evil originated in the great trochanter. The case of another young man, an individual aged 40 years, a boy aged 13, and a woman who died after lying in, together with

3 or 4 other patients whose bodies I have been enabled to examine after death, exhibited the same kind of lesions, and have proved to me that the great trochanter alone is often affected in such manner as to admit of its extirpation, in cases which would appear to indicate disarticulation of the thigh or abscesses by congestion, (*des abcès. par congestion.*) The consideration of these facts, and the cases of destruction of the great trochanter related by Gelée, (*Journ. de Méd. Milit.*, t. IV., p. 230,) Le Dran, (*Obs. Chir.*, t. II., p. 286,) M. Knox, (S. Cooper, *Dictionnaire de Chir.*, t. II., p. 156,) and Cadran, (Bagieu, *Examen de plusieurs Quest. de Chir.*, t. II., p. 493,) soon suggested to me the idea of an exsection of this part, which Tenon, (*Mém. de l'Institut*, an VI., t. I., p. 208,) had broached, and M. Champion, (*Thèse*, etc., p. 67,) formally recommended, and which M. Kluge and M. Jæger, it is said, had also suggested. I made trial of it on the dead body in 1832; and this operation was performed by me for the first time, at the Hospital of La Charité, in the month of November, 1835. I have since performed it again upon a student of medicine in the year 1836.

The first case was that of a woman, aged forty years, the external and upper portion of whose thigh had been in a state of disease for ten years, and perforated with fistulous openings. Having satisfactorily ascertained, and with the concurrence also of the opinion of M. Mott, who was then at Paris, that the great trochanter was in a carious condition, I laid bare this process by means of a T incision, the stem of which, directed transversely, extended from the anterior border of the great trochanter to two inches behind it, towards the tuberosity of the ischium. I had thus two triangular flaps, which I dissected and reversed upon their base, the one above and the other below. While one assistant held them down and another drew the anterior lip of the wound towards the groin, I removed lamina by lamina, by means of the concave rowel saw, directed from before backwards, almost the entire substance of the great trochanter. No serious accidents supervened, and many months were required to complete the cicatrization of the wound; but the patient ultimately left the hospital perfectly cured.

The young man mentioned, had had from his infancy, and in consequence of an enormous abscess, a sinuous ulcer opposite the great trochanter, which from time to time brought on attacks of erysipelas and a renewal of the suppuration. Believing that the sub-cutaneous mucous bursa was its point of departure, I had, two years before, completely excised this pouch. As the ulcer was not thereby closed, and as the same accidents were reproduced, I was convinced that the great trochanter itself was actually diseased. The courage, moreover, and firm resolution of M. D——, emboldened me to undertake upon him the operation which had succeeded so well in the woman whose case I have just described.

I adopted the same course in respect to the incision and the dissection of the integuments. I also removed, by the same process, with the concave rowel saw, a portion of the laminae of the osseous projection; but having ascertained that the caries and necro-

sis in some measure perforated, but in a very circumscribed space, through the whole thickness of the great trochanter, I concluded to substitute for the saw, first the trephine, and then the gouge and mallet. The operation was thus rendered longer and more painful; nevertheless, the totality of the disease was removed; the accidents were of a trifling character, and the cure has continued complete up to the present moment, (Jan., 1839.) Even before the expiration of two months after the exsection, M. D. was enabled to go out, and to resume in part his usual occupations.

These two facts decide the question beyond dispute, that the excision or exsection of the great trochanter may be successfully performed upon living man. It is easy to perceive, also, that the process to be adopted cannot be the same for all the cases. To lay bare the bone and remove it, by one mode or another, is the principal object in view. The operation is constituted of two portions: one the division of the soft parts, the other the excision of the osseous tissues. If the integuments are not degenerated to great depth, nor strongly adherent to the femur, a semilunar flap, having its base behind the great trochanter and its convex border in front, is preferable to any other kind of incision. Laying bare the whole bone on its external face and anterior border, it enables us to detach from it afterwards its posterior border and apex, without the necessity of changing the primitive form of the wound. Upon the supposition, on the contrary, that numerous and large cicatrices, and fistulas, and ulcers, had totally changed the nature of the parts, we must be guided by them in our construction of the flaps.

The great trochanter, after being laid bare, may be exsected by means of the hand-saw or crested saw, directed from before backwards, from without inwards, and slightly from below upwards. These instruments even would be preferable to all others, if it became necessary to remove the whole of this process from the femur. In cases, on the contrary, where the caries or necrosis has more breadth than depth, it would be better to make use of the concave rowel or a large flat rowel, seeing that this kind of saw enables us to avoid the insertion of the three glutei muscles, and dispenses with the necessity of proceeding as far as the synovial cavity, situated upon the posterior part of the neck of the femur. If, as in the case of the student of medicine which I have just given, the caries, though deep, occupied but a very limited space, it would be better to embrace it within the crown of a trephine, and to make use afterwards of the gouge and mallet, rather than to have recourse to the instruments of which I have been speaking. We are enabled, also, by this means, to avoid the same tendons just spoken of, and to destroy every thing which is diseased, without necessarily exsecting through the whole thickness of the great trochanter.

If, however, the crown of the trephine has to be carried to the point of penetrating through and through the whole extent of the great trochanter, there would then be less danger, I think, in removing the entire process by means of the ordinary saw, than by boring (troner) it in the manner described. The tissues are too relaxed,

and purulent collections take place too readily and are too dangerous behind the coxo-femoral articulation, not to induce us to endeavor, by every means in our power, to respect the parts in question and to avoid entangling them at least with any species of constriction in the direction towards the surface.

The vessels to be avoided in this operation are generally of inconsiderable size. The posterior circumflex artery, when we are obliged to penetrate to a great distance behind, and the anterior circumflex if the incisions are much prolonged above and in front, are in fact the only arteries which require our attention, or may have need of being tied.

During the whole time of the operation, the patient should be kept upon his sound side, with the thigh in a state of semi-flexion during the incisions upon the skin—to be placed in complete flexion, with adduction and rotation inwards, at the moment of performing the excision or exsection of the bone. By this position, the trochanter is naturally liberated from between the muscles and the lips of the wound. Adopting this course also, we find, when we afterwards straighten the limb, that the wound, in great part, closes of itself, and the denuded surface of the bone is made to conceal itself underneath the integuments of the thigh.

If we should go too far and too deeply in the posterior region, we might possibly wound the great sciatic nerve, or the descending branch of the ischiatic artery. The gluteus minimus, and medius muscles, which are attached to the upper border and to the front part of the great trochanter, need not be implicated, unless we are obliged to remove the entire process. In this last case it is still advisable if we can, and if the extent of the caries permits, to save the gemelli muscles and the pyriformis and obturator externus; but there is no way of avoiding the quadratus femoris muscle, except by restricting the excision as much as possible to the outer surface and middle portion of the great trochanter, whether we use the concave rowel saw, the trephine, gouge, or chisel.

It will be exceedingly rare that we can ever dress the parts in such manner as to undertake immediate reunion. The tissues in these cases are endowed with too unequal degrees of vitality; the wound presents layers that are too dissimilar and too much altered to admit of our attempting primitive agglutination. I would therefore recommend that we should apply naked upon the wound small balls of lint (*boulettes*) over all the anfractuosités of the traumatic surface, that we should gently arrange the flap over these *boulettes*, by means of a few strips of adhesive plaster, and then cover the whole with the perforated linen, spread with cerate, succeeded by a large gateau of lint, a few compresses, and the square bandage, or the pelvic spica lightly put on. [See Vol. I. for a description of *Dressings*.]

The patient being carried back, or having returned to his bed, should be kept there, either on his back or partly on his side, with the leg and thigh very moderately flexed and supported upon a cushion.

As after all exsections or excisions in the continuity of the bones,

we must not in these cases, proceed to the second dressing until after the second or third day, unless there should be particular indications to the contrary. The dressing is then to be repeated daily with the same articles as used in the first, and until the whole interior of the wound shall have acquired a healthy aspect, (se soit vascularisé,) assumed a rosy tint, and become covered with uniform cellular granulations. It is then only that we can dispense with the boulettes of lint without inconvenience, or think of contracting the wound; in this matter, however, we should still err in being in too great haste. We had better delay a week than go forward too fast. In leaving the solution of continuity to close up by second intention, we are almost certain to escape the danger of inflammation and purulent collections in the neighborhood of the external iliac fossa, or the coxo-femoral articulation, besides having much less to fear from the denudation and suppuration of the periosteum.

There is no impropriety, moreover, if every thing goes on regularly, in permitting the patient to get up and walk about even after the second or third week. In conclusion, the exsection of the great trochanter appears to me to be an operation susceptible of frequent application, and of a nature calculated to prevent in some instances the necessity of disarticulation of the thigh. I will not terminate this subject without adding that the free border of the semilunar flap, of which I have spoken, may, instead of being brought in front, be placed almost with the same advantages behind, below, or even above, should the diseased condition of the integuments seem to render it necessary.

[EXSECTION OF THE FEMUR.]

M. Ollagnier, a military surgeon, doubts the propriety (See *Gaz. Méd. de Paris*, 1843, and *Jour. des Connaiss.*, &c., de Paris, Mars, 1843, p. 113-114) of rigidly adopting in every instance the law in surgery of amputating the thigh in comminuted fracture of that bone from gun-shot wounds, where the fragments cannot be removed; but proposes as a substitute, where the fracture is in the upper fourth of the femur, and where the soft parts are not so lacerated as to threaten gangrene, nor the principal nerves and vessels injured, that we should exsect the bone under the great trochanter. For this purpose, he adopts the simple incision, as directed in exsections of this bone, in the text of our author, M. Velpeau, (above,) with a slight modification. His process is as follows:—An incision from the middle of the space comprised between the anterior superior spinous process of the ilium and the great trochanter, made in such manner as not to wound the capsule, but to enable us to explore with ease the neck of the femur, and to appreciate the extent of the disease. If exsection is intended, the incision should extend to four fingers' breadth below the great trochanter, and if it should become necessary to remove the neck of the bone, the capsule will have to be opened. The surgeon should take care, at first, to extend the incision no farther

down than to the great trochanter ; for if the lesion should indicate disarticulation of the femur, the wound will be quite sufficient, and the operation may be performed in the manner recommended by M. Baudens. If, however, the upper part of the thigh can be preserved, this wound would be a complication of little consequence, and amputation could be made in the continuity of the bone, which operation, M. Ollagnier states, has been attended with much more success in the late campaigns of the French army in Africa, as well as everywhere else, than disarticulation. It is thus perceived, that M. Ollagnier says nothing of the proposed law of M. Syne, of Edinburgh, (see above,) never, when disarticulation is not necessary, to amputate elsewhere than at the great trochanter or the condyles. T.]

PART SECOND.

EXSECTION OR EXCISION OF THE ARTICULATIONS.

Though there may be no articulation in the limbs at the present day, upon which exsection has not been made trial of, there are some upon which this operation has been much more frequently employed than upon others. As a general rule, exsection is much better adapted to the thoracic than to the pelvic extremities ; and there so much the more so, as the articulation is less approximated to the trunk. Though apparently of modern origin, exsection of the articular extremities of the bones was not unknown to the ancients. Hippocrates alludes in vague terms to that of the foot and hand :—*ET IN TIBIA AD MALLEOLOS, ET IN CUBITO AD JUNCTURAM MANUS.* It is very natural indeed, that ignorant as they were of all hemostatic means, they should have preferred all operations that would enable them to avoid amputation of the limbs. None of them however furnish us with the details of the processes they followed. It is from the time of White, only, that exsection of the joints became recognized as a distinct operation in surgery ; and it was about the middle of the last century that we have in England the first formal recommendation to exsect the articular extremities of bones that had become dislocated and had perforated through the tissues. It was Gooch, (*Cases and Practical Remarks in Surgery*, p. 323, 1737,) Cooper, of Bungay, (Gooch, *Opér. cit.*) Kirkland, (*Thoughts on Amputation, &c., &c.*, 1780,) the surgeons of the hospital of Liverpool, (Park, *Cases of the Excision of Carious Joints*, p. 73, 1806,) (of whom Park was one,) and Kerr, Hey, and B. Bell, who regularly established this operation in that country.

In 1776, the same doctrine was promulgated in France by Bourbier, (*Dissertat. Med. Chirurg.*, De Necessitate et Utilitate, &c., § XXI., 1776 :) In luxations, says he, where the bone protruded

out of the articulation, presents considerable length and resists reduction, *the only means of safety left at the disposal of the surgeon, is to exsect the projecting bone*; but the operation continued at first to remain there completely unknown. Lassus, (*Nouv. Méth. de traiter les Malad. qui attaquent l'Articul. du Coude et du Genou*, par Park, p. 6, 1784,) who, in 1784, alludes to the recommendation of Gooch, and his practice, and that of Cooper, of Bungay, is silent upon this subject, in his notes to the Treatise of Fractures by Pott, in 1788. So that it is not until the year 1789, that we meet with the recommendation of exsection of luxated bones, in our classical works. Manne it was, who was the first among us to propose it, (*Traité Elém. des Mal. des Os*, p. 266, 1789.) As Park, (*Nouv. Méth.*, &c., trad. par Lassus, 1784,) who in the beginning was desirous of extending exsection to all the joints, ultimately attached much less importance to it, it was Moreau, (*Obs. Prat.*, etc., 1803; *Résec. des Os*, etc., 1816,) in fact, who was the first to demonstrate its advantages to the surgeons of Europe. The dissertation of Wachter, (*De Art. Extirpan.*, Gron., 1810,) published in 1809, being much more theoretical than practical, would have remained in oblivion, like that of Chaussier, (*Soc. Méd. d'Emulation*, t. III., p. 397,) but for M. Champion, (*Thèse de Paris*, 1815,) who, by new facts, dispelled the last doubts on this subject that lingered in the minds of the Parisian surgeons. The observations of MM. Roux, (*De la Résec.*, &c., 1812,) Jeffray, (*Excision of Carious Joints*, &c., 1806,) Crampton, (*Arch. Gén. de Méd.*, 1er série; *Dublin Hospital Reports*, Vol. IV.,) and Syme (*Excision of Diseased Joints*, 1831) have finally succeeded in fixing public attention upon this subject.

Exsection of diseased articulations, however, is not yet approved of at the present time by all practitioners. Compared with amputations, in fact, its advantages and disadvantages are so balanced, that it is allowable to hesitate before according to it any absolute utility. Its manual process, which is delicate, painful and ordinarily very long, presents under some circumstances numerous difficulties, and necessarily involves acute suffering: also it may incur the risk of not removing all the mischief. As it removes the bones only, it necessarily leaves behind the greater part of the other degenerated tissues. The wounds which are produced by it being extensive and irregular, almost always become the seat or the source of an abundant suppuration. The cure, too, even when it does take place, is not effected until after the expiration of many months, sometimes not until after several years. The limb being more or less shortened, often immovable, and generally drawn by the muscles into one direction or another, remains moreover sufficiently deformed to be rendered incapable of performing more than a limited part of its functions.

Amputation being generally easy and prompt, and consequently less painful, immediately disembarasses the patient both of the bones and all the soft parts that are diseased. Acting upon sound tissues, it leaves a smooth wound, one easy of union, less extended, less disposed to suppurate, and less favorable to the development of

phlebitis and metastases. The cure which is more probable and more speedy, is also more free, (*franche*,) and more complete.

To these objections, however, which are not wanting in force, it may be replied, that it is for the skilful surgeon to know how to surmount the difficulties of the manipulation in exsections, and to abridge their duration, and determine whether he can or cannot remove all the mischief. The bones being once removed, the surrounding tissues, however changed they may be, return most usually to their natural condition. The fungous or lardaceous degenerescence of the synovial capsule, ligaments, cellular tissue and skin, is not always an obstacle to the cure. The principal arteries, veins and nerves being avoided, the operation ought in reality to produce less shock (influence) upon the rest of the organism than amputation properly so called. Certain patients moreover get well with great rapidity, as M. Syme mentions cases in which they were enabled to make use of their limb at the expiration of a few weeks. The new substance which is formed in the place of the osseous extremities excised, acquires a sufficient degree of solidity, to replace to a certain extent the articulation and to admit of voluntary movements. By means of splints and skilful dressing, we may counteract every abnormal deviation of the limb, and prevent its ankylosis by habituating it in time to proper movements. In fine, however deformed we may consider it, this limb will always be adapted to a greater or less number of uses which the patient would regret to be deprived of. In the aggregate the number of advantages in exsection is greater than its inconveniences. It is therefore an operation, which rigidly examined, deserves to be reckoned among the efficacious resources of surgery.

The preparatives for the operation, (*l'appareil*,) are composed : 1, of the same objects as those for amputation, in order that if unexpected accidents or circumstances should arise, at the moment of the operation, we may be enabled to proceed immediately to the removal of the limb, in place of restricting ourselves simply to exsection ; 2, of some particular articles, as for example, strong spatulas, gouges, a leaden hammer, chisel ; hand, crested, *rondache*, semicircular, or chain saws, and that of Machell, and the flexible saw, as frequently used by the English and American surgeons ; M. Heine's saw, the rowel saws, that of M. Thall, the osteotomes of M. Zeiss, and the cutting pliers of M. Liston ; 3, finally of one or more thin pieces of pliable lightwood, (*bois blanc*,) pasteboard, sheet-lead, (*plomb*,) or any other metal, or merely narrow compresses, folded several times double, and suitable for slipping in between the bones and soft parts. We must have, moreover, for the dressing, one of the bandages of Scultetus, cushions, and splints, or what is better the starched bandage.

CHAPTER I.

THE THORACIC EXTREMITY.

ARTICLE I.—THE HAND.

IF the anterior third, or the posterior third, of 1 of the 4 last bones of the metacarpus, or of any phalanx, was alone diseased, it might be removed without requiring the removal of the finger. Many surgeons have undoubtedly thought of, and some have performed this operation, as is shown by several theses, supported at the beginning of this century. It is to Troccon, however, to whom we are indebted for having proposed to subject this operation to certain fixed rules. M. Wardrop, (*Trans. Méd. d'Edinburgh*, 1819,) who removed in this manner the head of the second metacarpal bone, is far from being the first who first performed it on living man. Galen, (*Opera apud Juntas*, t. I., lib. 3, cap. I., p. 72 bis) relates that a surgeon of much repute, by dividing a bone of the wrist, which was sphacelated, rendered the whole palm of the hand sensitive (sensible) by the manner in which he operated, for want of sufficient anatomical instruction. Bilguer, (*Diss. sur l'Inut. de l'Amp. des Membres*, p. 70,) says that in wounds from fire-arms, he has detached and removed the bones of the hands entire, either where they were fractured and shattered or not. M. Textor has removed the os magnum (grande os) in a carious state, (Jæger, *Œuvr. cité*, p. 23, No. I.,) together with the posterior extremity of the third bone of the metacarpus. In a case of M. Champion, (*Résect. dans la Continuité*, p. 59, 1815,) after the exsection of the anterior half of the fifth bone of the metacarpus, the movements of the finger were re-established, although it was an inch shortened. Vigarous, (*Œuvres Chir. prat.*, p. 435,) by means of an incision on one side of the index finger, extracted the second phalanx in a state of necrosis, and also its epiphysis, which had separated from the body of the bone. A perfect cure was effected in thirty-three days, and the patient could afterwards use his finger with the greatest advantage.

§ I.

The luxated and irreducible head of the *first phalanx* of the thumb was exsected in this manner successfully at the time of Cooper, (*Practical Treatment of Wounds, &c.*, 1767,) or Gooch, and Lassus, (*Trad. de Park*, p. 7, 1784,) and afterwards at the beginning of this century, by M. Bobe, (*Journ. Gén. de Méd.*, t. XXVI., p. 163 ; t. XXVII.) M. Evans, (S. Cooper, *Dict.*, &c.,) effected two similar cures, and M. Roux, and M. Textor, (Colon, *Thèse*, Wurtz-

burg, 1833, p. 46,) have been no less fortunate on other metacarpal bones.

In these cases, moreover, exsection forms but a stage of the operation of extraction, properly so called, of the same pieces of bone. After having divided the integuments, separated the extensor tendons, and grazed the bone on each side in order to detach from it the inter-osseous muscles, and after having disarticulated the extremity, correctly ascertained, of that which we wish to remove, there is no more to be done than to glide a piece of wood, pasteboard, &c., underneath its anterior surface, then to make its section slantingly, (*en biseau*—*i. e.*, bevelled,) or perpendicularly, by means of a small saw, such as the chain saw of M. Jeffray, or that of M. Rambaud.

The surgeon of the present day having at his command instruments better adapted to the operation, would not be under the necessity of attending even to so many precautions. The incision of the integuments being made, he would divide the bone with Liston's cutting pliers or the flat rowel-saw, and then terminate with the disarticulation. The corresponding extremity of the phalanx would be extracted in the same way, if it participated in the disease. M. Fricke (Gernet, *Arch. Gén.*, 1838, t. II., p. 87. This name is written *Guernet*, in the *Dict. de Méd.*, art. *MAIN*; and Gernet, *Gaz. Méd.*, 1837, p. 555,) who confined himself to the excision of the third metacarpal bone in one case, exsected the entire metacarpo-phalangeal articulation of the thumb in three other patients. As the tendons are not destroyed in this kind of operation, the fingers which are saved are enabled to resume a part of their functions.

"The first, second and fifth bone of the metacarpus," says M. Champion, (*De la Résection des Os, Thèse de Paris*, No. 11, 1815,) "may be excised in part without involving the loss of movement in the fingers, inasmuch as the incisions are made laterally, and the extensor and flexor tendons thus avoided; the consolidation even is not an obstacle to the success of this operation."

§ II.—*Extraction of the First Bone of the Metacarpus.*

It may be conceived that this bone may be in a state of necrosis, caries, or degenerescence, without the thumb and carpus being implicated in the disease, in which case it would be important to be enabled to remove it while preserving all the other parts. Troccon (*Amp. Part. de la Main*, etc., 1816,) in 1816, maintained the practicability of making this extraction. Nevertheless M. Roux (*Bull. de la Fac. de Méd.*, t. VI., p. 156) appears to have been the first who made a practical application of this suggestion upon living man. The thumb, in his patient, which at first could not be put to any use, gradually acquired its natural functions, so as to be enabled to execute very considerable movements. The same practitioner has since been equally fortunate in two other cases. I am acquainted with a person, who, after the first phalanx in a state of necrosis had been extracted by piecemeal, preserves nevertheless all the movements of his thumb. I was not aware, in 1825, that M.

Trochon had spoken of it, and as M. Roux has no where given a description of his operation, I deemed it proper to enter into some details as to the best method to be adopted (*Anat. des Régions*, t. I., p. 458, 1825.) The operation having been performed again in 1827 by M. Blandin, (*Nouv. Bibl. Méd.* 1828, t. I.,) we may look upon it at the present time as one which is regularly established in surgery.

First Process.—We commence with an incision upon the radial border of the bone, which it is important to prolong at least half an inch posteriorly and anteriorly [beyond the part diseased? T.] We then cautiously detach from its dorsal surface the integuments and the tendon of the extensor secundi internodii pollicis; we then do the same with the opposite muscle and the tendon of the flexor longus pollicis manus, which cover its palmar surface. While an assistant keeps apart the two lips of the wound, the surgeon directs the point of his bistoury upon the outer side of the carpal articulation, divides the tendon of the extensor ossis metacarpi pollicis, (long adducteur,) or even that of the extensor primi internodii pollicis, while carefully avoiding the extensor secundi internodii pollicis; then destroys all the ligaments and all the fibrous parts which unite the metacarpal bone to the trapezium, and endeavors to luxate this bone outwardly, either by a simple pendular movement (*en bascule*) or by drawing upon it in that direction with the forceps; he then seizes it with two of his fingers, glides the bistoury along its ulnar side in order to separate the tissues from it, and disarticulates it while dividing in succession the internal lateral ligament, the external lateral ligament, then the anterior fibrous layers which unite it to the thumb, which latter is thus left still invested with its tendons of the extensor secundi internodii pollicis, the flexor longus pollicis manus, the abductor pollicis manus, the flexor brevis pollicis, and the adductor pollicis, while at the same time we preserve the whole thenar eminence entire. Nor is it necessary to divide any artery of any considerable size. Consequently it is rare that we have occasion to leave the threads in the wound, the two lips of which latter are brought together from before backwards, and maintained in this state by means of small graduated compresses or by lint, and then strips of adhesive plaster or a few points of suture. The palm of the hand is then padded (*garnie*) in a proper manner, in order that the thumb may be kept by means of a bandage in its natural position.

Second Process.—Performed in this manner, however, the operation is long and difficult. I have since found that it is rendered incomparably more prompt, by making use of M. Liston's cutting pliers to divide the bone near its extremities, after having isolated the soft parts from them. If one of the articular heads itself is diseased, the same pliers used upon its sound portion renders its extraction more easy. In fine, excision is preferable here to disarticulation. [It will be seen by our abrégé below, of M. Chassaignac's processes of exsection throughout the body, that M. Velpeau herein virtually

gives the preference to the leading or ruling principle of those processes, to wit, that of excision always *before* disarticulating. T.]

§ III.—*Extraction of the Middle Bones of the Metacarpus.*

Troccon did not limit himself to recommending the extraction of the metacarpal bone of the thumb alone. He is of opinion that we may perform the same operation upon the others. I have often practised it upon the dead body, and am bound to say, that with an accurate knowledge of the articulations, we may perform it without any very great degree of difficulty. M. Dietz (Coulon, *Thèse*, Wurtzburg, 1833,) by operating in this manner, was enabled to preserve the fore-finger of his patient. We make an incision which is to reach from the carpal extremity of the fore-arm to half an inch in front of the phalangeal articulation, while taking care to avoid the extensor tendon. Then in order to disarticulate the bone posteriorly, we proceed as above directed. When it is luxated we seize it with two fingers or the forceps, while with the point of the bistoury we proceed to divide the posterior part of the capsule, the lateral ligaments and anterior ligament of the other articulation, always carefully avoiding the extensor and flexor tendons of the corresponding finger.

In place of commencing posteriorly as Troccon recommends, I think with M. Blandin, who re-introduced this subject in 1828, that it is better to disarticulate the phalangeal extremity first, and terminate with the section of the ligaments of the carpus; but it is probable that this operation will continue to be for a long time, with the greater part of practitioners, nothing more than one that has been merely projected. Exsection of the diseased bone appears to me to be an operation calculated to be advantageously substituted for it on almost all occasions.

M. Textor (Coulon, p. 35, *Thèse*, Wurtzburg, 1833) was enabled to remove the articular extremity only of the third metacarpal bone, and yet preserve the finger. When once laid bare upon its dorsal surface, each bone of the metacarpus could be divided either posteriorly or anteriorly very near its articulation, by means of M. Liston's pliers, and removed without any great effort. Examined in this point of view, the operation is one of very great simplicity, and cannot be assimilated in any respect to the *exarticulation* of Troccon.

§ IV.—*Extraction of the Fifth Bone of the Metacarpus.*

From its having been found practicable to remove the first metacarpal bone and at the same time to save the phalanges, the same operation has been suggested for the metacarpal bone of the little finger. It is an operation which is no doubt possible, and even sufficiently easy, but it is of less importance than at the thumb; so that the preference will always probably be given in these cases to simple disarticulation with the simultaneous removal of the finger. If, however, extirpation should be decided upon, this is the manner

in which we should proceed. A dorsal incision extended from the head of the ulna to the middle of the ulnar border of the first phalanx of the little finger, would enable us to detach the bone from the tendons and other soft parts which cover its dorsal and palmar surfaces. An assistant should be charged with separating the lips of the wound apart, while drawing them at the same time towards the radial side; the surgeon would then divide with the point of the bistoury the tendon of the extensor carpi ulnaris, and afterwards the various fibrous bundles of the articulation; he would then move the bone backwards and forwards [*ferait basculer*, that is, a swinging or pendulous or vibratory movement, or from side to side, as frequently explained above, see Vol. I., and this Volume, T.] in order to luxate it; glide the bistoury flatwise upon its radial surface, then isolate it to near the anterior articulation, and separate it from the first phalanx of the little finger while carefully avoiding the extensor and flexor tendons of this last mentioned appendage. Liston's pliers should also be used here as with the first metacarpal bone.

§V.

The dangers of the operation, also, in whatever way it may be performed, are the same as those from amputation, and M. Fleury (*Journ. des Conn. Méd.-Chir.*, 1838, p. 249) mentions a case which, after he had exsected the anterior half of the second metacarpal bone, terminated fatally by purulent infection.

ARTICLE II.—THE WRIST.

Others besides Moreau, M. Roux, and M. Hublier (*Bull. de Férussac*, t. XVII., p. 400) have excised the carpal extremity of the fore-arm. According to M. Bohe, this operation was performed with perfect success about the year 1800, by M. Clémot of Rochefort, or rather by M. Saint-Hilaire, (*Os de l'Avant-Bras*, *Thèse*, Montpellier, 1814, p. 10,) on a patient in whom the radius and ulna having been luxated, protruded to considerable extent through the lacerated soft parts. Cooper (Lassus, *trad. de Park*, p. 7) had been no less fortunate half a century before. The attempt of M. Hublier also succeeded completely, and is to be enumerated under the same head. There was in this case dislocation of the hand, laceration of the integuments, and protrusion of the bones externally. The extensor and flexor tendons, not being wounded, the surgeon resolved to remove the exposed portions of the radius and ulna, after having properly isolated them; the hand and fore-arm were then replaced in their natural position, and after the cure, which was attended with no untoward accident, the movements of the fingers could be executed with almost as much facility as before.

We undoubtedly ought not to hesitate in such cases, should the reduction of the bones be impossible, or be attended with too much difficulty; but there is another kind of exsection whose utility is not

so well demonstrated; I mean that, for example, which relates to organic lesions, more or less ancient, caries, necrosis, or osteo-sarcoma. These diseases, in fact, are rarely sufficiently serious at the wrist as to require an operation of this kind, without there being present also at the same time, a profound alteration of the bones of the carpus and of the soft parts which surround them. How then can the operative process be submitted to rules that are in any respect precise?

Nevertheless it is an operation which many surgeons have made trial of. M. Malagodi (*Journ. des Conn. Méd.*, t. II., p. 201) who ascribes cases of this kind to MM. Withusen, Cittadini, Warmuth, and Holscher, appears in this matter to have mistaken one articulation for another. As to what regards himself, he has in this manner removed the ulna, the styloid process included, as high up nearly as the coronoid process, and his patient who recovered could afterwards use his hand as well as he could before the disease existed. The lower extremity of the ulna also appears to have been exsected successfully by M. Jæger, (*Heine, Gaz. Méd.*, 1834, p. 645.)

"The *coude* or ulna, says M. A. Séverin, (*Méd. Efficace*, § 954. This case, says M. Velpeau, could be claimed as well almost for a fracture as for a luxation,) which was dislocated inwards from the wrist, (qui sortait en dedans du poignet,) and which was fractured, not yielding to reduction, in spite of the strength of three robust men, Master Blaise and myself sawed the ends of the bone which protruded, and the patient got well." M. Breschet (*Mém. sur les Luxat. du Poignet*, &c., par Malgaigne, p. 39, 1833) also appears to have exsected an inch and a half of the ulna, which had been luxated inwards and protruded through the integuments. The carpal extremity of the radius was denuded, black, and dry, and had been luxated for six months in consequence of an abscess, (dépôt.) The father of the child dividing the bone on a line with the soft parts, by means of the chisel and mallet, took off three inches of it, and two hours after detached two inches more, which constituted a part of the first portion. The patient can use (tire) a great portion of this hand, though its movements are feeble, (Champion, *Traité de la Résection des Os Cariés dans leur Continuité*, etc., p. 57; but the details of the extent of the necrosis, says M. Velpeau, are not given.) Orred (*Trans. Phil.*, t. LIX., part. 1ère, art. 2, 1779) speaks of a surgeon who exsected three inches of a carious ulna, (probably *necrosed*, says M. Velpeau.) The patient was so well cured by the reproduction of the removed bone, that he continued to pursue his customary labors in the country. In a case cited by Bagieu, (*Examen de plus Part. de la Chir.*, t. II., p. 443, 440, obs. 7,) the head of the two bones was fractured by a ball; the splinters were immediately extracted; a shortening of more than an inch took place; the radio-carpal union became ankylosed; nevertheless a sufficient degree of flexibility was preserved to the fingers to write and design almost as well as before the wound. This operation was performed by Moreau the father, in July, 1794, for a necrosis caused by an acute inflammation, on J. P. Husson, a

notary seventy-one years of age, who had already lost his left hand, and who died on the 29th of the same month, from exhaustion consequent upon the intensity of the primitive inflammation. Another patient of Moreau recovered perfectly. One of the two operated upon by M. Roux died, the radius only having been exsected.

Upon the supposition that exsection of the wrist may become necessary, there are two or three methods which might be adopted, and which have been made trial of.

§ I.—*Process of the Author.*

An incision on each border of the fore-arm, one from the root of the thumb, the other from the last metacarpal bone, to extend to two inches above the styloid processes of the radius and ulna, and to be united by a transverse incision on the posterior surface of the fore-arm, would enable us to reverse from above downwards a flap upon the back of the hand, whereby the entire dorsal surface of the articulation would be laid bare. I then proceed immediately to the disarticulation. The tissues on the anterior surface are then detached from the bones, and protected by a thin piece of flexible wood, sheet-lead, or pasteboard. This being done, we divide, with the same cut of the saw, both the radius and ulna, above the seat of the disease. The flap preserved is united to the opposite lips of the wound by a few points of suture. A gentle pressure approximates its anterior surface to the bottom of the wound, [*une douce pression en rapproche la face antérieure du fond de la plaie ; i. e.,* brings the raw surface of the flap, which it must be recollected is on the back of the wrist and hand, into proper contact with the bottom of the cavity left by the exsection. T.] and it is not impossible that the extensor tendons may ultimately re-acquire their action upon the fingers.

By this process, the operation is performed with great ease upon the dead body, and we may avoid, without difficulty, the radial and ulnar arteries, while detaching the tissues from the anterior surface of the wrist.

§ II.—*Process of M. Dubled.*

M. Dubled, having made his first incision on the inside, after the manner of Jeffray, dissects the lips of the wound from the posterior surface, and then from the anterior surface of the ulna ; causes them to be drawn to the outside ; divides the lateral ligament places the hand in the position of abduction ; completely isolates the head of the bone ; makes it project as much as possible outwardly ; detaches it from the radius ; passes between it and the latter a piece of sheet-lead or wood ; and then, with the saw, cuts above the seat of the disease, through the whole thickness of the affected bone. The same process is then applied to the outer border of the articulation ; and as the ulna has already been exsected, it is then more easy to turn the hand inwards and to throw the ra-

dius outwards, and thus effect its excision. By this process, all the tendons would be saved, and the consequences of the operation evidently more simple. In repeating it on the dead body, I have found it of very easy execution; but it is not probable that it would be equally so on living man, and on a deformed hand.

§ III.—*Process of Moreau.*

The operative manual adopted by MM. Moreau, Ronx, and Syme, while it is not much more complicated than that of M. Dubled, has however the advantage of rendering the excision of the articular heads infinitely more easy. A transverse incision, which commences at the carpal extremity of each lateral incision, and which is prolonged from eight to twelve lines upon the dorsal surface of the wrist, circumscribes two little flaps, in form of an L, on the posterior region of the radius and ulna. These are dissected and raised up, one after the other, commencing with that of the ulna. After having pushed aside, detached, and isolated the tendons, we endeavor, by means of a spatula, to insinuate a protecting compress between the two bones, and which is to be brought out from the inter-osseal space, so as to come between the palmar surface of the ulna and the soft parts. An assistant immediately seizes it, and draws its two extremities towards the radius, in order that the tissues may be also thus drawn in the same direction. With one cut of the saw, the surgeon then effects the section of the bone, which he afterwards detaches, by means of the bistoury, from the carpus and radius. He then immediately proceeds to the dissection of the second flap, also to that of the great number of tendons on this side, and the radial artery. To terminate, he has only to repeat on the radius what he has just done on the ulna. The patient thus operated upon by Moreau recovered. The case, however, has not been given with sufficient details to determine the precise value of the fact to which it relates. The patient of M. Ronx (Dubourg, *Journ. Univers. Hebdom.*, t. II., p. 358) was doing admirably well on the fifteenth day after the operation; but was afterwards obliged, it is said, to undergo amputation.

If only one of the bones should be diseased, we should, it may be readily understood, confine ourselves to a single flap and single wound. If the head of the ulna only was to be excised, the simple incision of M. Dubled and M. Liston's sector (*sécatteur*) would be sufficient. The process, however, indicated under the head of *Exsection of the Body of the Bones*, would become indispensable, if, as in the case of M. Malagodi, the diseased portion of the ulna or radius extended very high up. The vertical rowel saws, moreover, and the osteotome of M. Heine, would, at the present day, render the operation more easy, by enabling us more conveniently to avoid the soft parts. By means of the concave rowel saw, as has been mentioned above in speaking of the malleoli, we might in fact, and indeed should, where a portion of the head of the radius only is diseased, exsect it without opening into the joint.

The process, however, which I have described in the beginning is the easiest of all; this of itself would enable us to excise, at the same stroke, the head of the bones of the carpus, (*la tête des os du carpe*,) if that was diseased. The facts stated under the chapter on *Deformities*, (see Vol. I.,) authorize us, at the present day, to indulge in the belief that the transverse incision of which I have spoken would not destroy the action of the extensor tendons of the fingers.

ARTICLE III.—THE ELBOW.

Exsection of the elbow joint, first successfully performed by Wainman, (*Jeffray, Opér. cit.*, p. 10,) who, however, removed only the trochlea (*poulie*) of the humerus for a luxation of the elbow; suggested, in 1781, by Park, with the view of applying it to chronic diseases; performed on living man, in 1782, by Moreau, and a little later by Percy (Moreau, *Résect. des Os*, p. 57,) and many other military surgeons; has been made trial of six times by M. Roux, twice by M. Crampton, fourteen times by M. Syme, and once by M. Spence. Since these first essays, MM. Moreau, father and son, MM. Champion, (*Ibid.*, p. 57; *Journal de Corvisart*, Mars, 1813; *Bull. de la Fac.*, t. III., p. 20,) Mazzoza, (*Journ. des Conn. Méd.*, t. II., p. 201,) Jæger, Textor, Moisisowitz, (*Heine, Gaz. Méd.*, 1834, p. 465,) Delpech, Dietz, Kern, Sanson, (*Coulon, Op. cit.*, p. 45,) and others, have related new and sufficiently numerous examples of it.

§ I.—*Process of Park.*

Park thought it sufficient to restrict himself to an incision parallel to the axis of the limb, and extended to two inches above and below the olecranon. The two lips of this wound being held apart, he endeavored to divide the lateral ligaments and the tendon of the triceps muscle, and to luxate the extremity of the humerus backwards; but experiencing too great difficulty, he first excised the olecranon, and then attained his object with greater facility. This first stage of the operation being finished, Park effected the excision of the humerus about two inches above the articulation, on a piece of wood or metallic plate (*plaque*) inserted between the anterior surface of the bone and the tissues. The lips of the wound were approximated in such manner as to be kept in contact by means of strips of adhesive plaster.

In his letter to Pott, this surgeon admits that this process probably would not answer for a diseased and tumefied (*gonflée*) articulation; that in that case it would be necessary, 1st, to make a transverse incision, which should be placed immediately above the joint; 2, to dissect the four flaps which would be formed by it; 3, to lay bare in this manner the whole posterior surface of the bone; 4, then to remove in succession with the saw the inferior extremity of the humerus, and the upper portion of the bones of the fore-arm. Such a method cannot be strictly applicable to any case, any more in its primitive simplicity than associated with the crucial incision,

though something analogous was in one case employed with success by M. Syme.

§ II.—*Process of Moreau.*

In place of dividing upon the median line, Moreau commences by setting out from the condyles, and making his incisions on the borders of the humerus, dividing from below upwards the whole thickness of the tissues, to the extent of two or three inches. A third incision placed transversely, unites the two first immediately above the olecranon, which thus enables us to form a quadrilateral flap, which is dissected and raised up on the posterior surface of the arm. The bistoury inserted flatwise upon the anterior surface of the humerus, is then made to detach the tissues carefully from this part. A flat piece (lame) of flexible wood is then immediately after introduced in the place of the instrument, and the remainder of the operation performed as in the process of Park. If the extremity of the ulna and radius are to be removed, all that is requisite is to prolong the lateral incisions a little lower down, and to form, in this manner, a small lower flap, which, being dissected, renders the section of the bones which it covered a very easy matter.

§ III.—*Process of Dupuytren.*

The process of Moreau is the one that should be adopted, and which MM. Roux and Syme at least have followed in most of their cases. It has been deemed necessary, however, to modify their process in some respects. Thus Dupuytren has shown that the ulnar nerve, which they almost unavoidably sacrifice, may and ought to be saved. After having cut out a quadrilateral flap, and laid bare the upper extremity of the ulna in the manner of Park, Dupuytren begins by excising the olecranon, and then cautiously divides the sheath which contains the ulnar nerve behind the inner condyle, then pushes this cord inwards, and causes it to pass in front of the articulation, where an assistant retains it by means of a curved sound, the handle of a scalpel or even the finger, until the lower extremity of the humerus is removed.

§ IV.—*Process of Jeffray.*

Jeffray (*Opér. cit.*, p. 174) having devised his chain-saw, supposed that two lateral incisions would be sufficient, and that the crucial incision of Park, and the transverse incision of Moreau, were useless. His chain-saw requiring only a slit on each side in order to be passed around the bone, enabled him thus to preserve the continuity of the muscles and tendons uninterrupted, and to save the ulnar nerve, a crowning perfection being thus given to the operation which bore off the honors from Dupuytren.

§ V.

Process of Manne, (*Traité Elém. des Malad. des Os*, p. 50, 1789.)—A semicircular incision was first made at the postero-inferior part of the arm; a similar one at the postero-superior part of the fore-arm; then two longitudinal incisions were made, which extended from the extremities of the superior semicircular incision to those of the inferior; *the flap comprised between these incisions was then removed*, [*i. e.*, detached. T.]; the tissues were then carefully detached from the anterior and inner surface of the articulation; the periosteum was divided circularly around the bones; the tissues were then held aside with a bandage, and the bones sawed above and below the articulation; the lips of the wound were brought together, covered with lint, and the whole supported by an eighteen-tailed bandage, the arm and fore-arm being placed in a gutter or in fanons (see Vol. I.) upon a pillow.

M. Sédillot, adhering to the two semilunar incisions, eulogizes the process of Manne, as the one which is still the best.

§ VI.—*Process of the Author.*

A. The patient is to be placed upon his belly or upon his sound side. An assistant compresses the brachial artery, and supports the soft parts of the arm. Another holds the fore-arm. The surgeon placed outside, with a straight bistoury, makes his first incision two inches long on the outer border of the humerus, beginning or terminating it at the outer condyle, and prolonging it upwards in such manner as to separate the brachialis internus muscle from the outer portion of the triceps. A second incision is then made on the inner border of the arm, in such manner that, in order to avoid touching the ulnar nerve, its lower extremity may fall rather upon the side of the olecranon than upon the inner condyle. After having united these two first wounds by a transverse incision, which divides at the same time the tendon of the triceps, the flap is dissected and raised up with facility. An assistant then seizes hold of it, and if the extremity of the bones of the fore-arm appears sound, we proceed immediately to the exsection of the humerus. In the contrary case, we must prolong the lateral incisions downwards, and form a lower flap similar to the first.

B. *Second Stage.*—As soon as the cubital nerve is laid bare, we isolate it from the bridles which hold it down between the internal condyle and the olecranon, and then, while the fore-arm is placed in as strong extension as possible, we slip it, (*le porte*), as has been just said, over the inner tuberosity of the humerus. Then the operator draws forward the undivided tissues, and slightly flexes the limb; detaches with the point of the bistoury the muscular tissues from the anterior surface of the bone, passes in front of the humerus the plate (plaque) of wood, puts the saw in motion, embraces the upper extremity of the fragment of bone, which he

wishes to remove, separates all the tissues from it, in proportion as he reverses it from before backwards, and from above downwards, and then divides the anterior, external lateral, internal lateral, and posterior ligaments.

C. *Third Stage*.—If the ulna and radius are to be exsected, the surgeon detaches to a point below the disease the insertion (fin) of the brachialis internus muscle, as well as that of the biceps, and terminates by dividing the bones with the saw, directed from before backwards, or from behind forwards, according as the state of the parts may seem to require or render more convenient. In this case it is better also not to disarticulate the humerus, and proceed afterwards to the section of the radius and ulna. If the bones of the fore-arm are perfectly sound, it is difficult to conceive that the excision of the olecranon can be of any service. When they are diseased, the operation is necessarily longer and more serious, and as it appears to me, would present but slight chances of success, should it become necessary to make the exsection below the bicipital tuberosity of the radius, since we should then destroy the attachment of the two principal flexor muscles of the limb. The brachial artery being separated from the humerus by a thick muscle, is never difficult to be avoided. It would incur much more risk, if we were obliged to descend upon the fore-arm as far down as on a line with its bifurcation. It is a matter of great importance that we should make the section of the ulna and radius above the insertion of the brachialis internus muscle, and especially that of the biceps. M. Syme, however, as it appears, performed exsection below (au-delà) the tendon of these muscles, in some of his patients, who nevertheless preserved the functions of their hand.

D. *Fourth Stage*.—After having removed the bones, tied the vessels, cleansed and adjusted the wound, and ascertained that we have left no portion of disease behind, the fore-arm is to be brought into extension; the two flaps are to be brought together, united by two or three points of suture, and to be adjusted in the same manner at their edges to the anterior soft parts. [At present all tension of this kind by sutures, adhesive straps or even loose bandaging, or any pressure whatever, are, it would appear, by general consent to be rigidly proscribed. See note supra, under *Amputations*. The starch bandage would be particularly objectionable. T.] Gateaux of lint, a few graduated compresses, the bandage of Scultetus, cushions and two thin splints, or the *starch bandage*, [appareil inamovible—see note a few lines above, T.] would maintain the surfaces in contact, and the totality of the limb in a complete state of immobility. [This practice of immovability or immobility of the limb must be surrendered also with its accompaniments or congeners, [vid. notes above,] as it is all at war with the present most approved principles of treating wounds of joints, where the joints are exposed, whether such wounds are traumatic or surgical. The favorite starch bandage of our author, with every deference to him, must, we think, be confined to simple fractures, and then, only to be used where there is no inflammation, or where

it has entirely subsided. The articulations, when laid bare and lacerated, or fractured or luxated, or afterwards exsected, or where all these conditions exist together, must, it is now ascertained, be treated in the most gentle manner with light, soft dressings, and their flaps merely brought together; besides which, a slight degree of motion must in some way be kept up from the first. See our note *supra*. T.]

§ VII.—*Appreciation.*

The exsection of the elbow-joint, is a tedious, (minutieuse,) long and painful operation. It is rare that it is followed by perfect, immediate union. An abundant suppuration is frequently the result. One of M. Roux's patients was not perfectly cured until at the expiration of nearly a year. It cannot be had recourse to except in cases where the skin and a part of the muscles retain their natural state, or for a caries or simple necrosis, or a comminuted fracture of the articulation. All these circumstances have been calculated to intimidate practitioners, and have rendered the operation we are treating of more rare than would have been at first supposed. Nevertheless, it has constantly succeeded with the surgeons of Bar, [aux chirurgiens de Bar. (Paris?)] M. Roux, also, has had three fortunate results. His first patient, operated upon in 1819, recovered from the operation, but died of phthisis five months after. The second, became a knife-grinder, (remouleur,) on one of the bridges of Paris. The third patient, and whom I saw operated upon, resumed her profession of seamstress, and afterwards that of chambermaid. A fourth case, in whom a sudden hemorrhage rendered it necessary to proceed to immediate amputation of the arm, died three days after. Two others succumbed to the consequences of the operation. The patient of M. Mazzoza, recovered. That of M. Crampton, operated upon January 2d, 1823, himself signed his discharge on the 29th of November following. Out of the fourteen operated upon by M. Syme, from October the 1st, 1828, to October the 1st, 1830, two have died. A third, had afterwards to undergo amputation of the arm. Eleven recovered perfectly, some by almost immediate union, others after a greater or less length of time, and all have preserved, in great part, the uses of their limb. M. Syme, (Coulon, *Op. cit.*, p. 45,) was less fortunate in another case in 1831; but that of M. Spence, operated upon in 1830, also recovered perfectly.

In uniting to these facts, the two successful cases which belong to Wainman and Park, (Jeffray, *Op. cit.*, p. 68,) that of Justamond, (*Ibid.*, p. 55,) who removed the olecranon and two inches of the ulna, that of M. Harris, (*Gaz. Méd.*, 1837, p. 585,) whose patient recovered the use of his elbow-joint, that of M. Warren, (communicated by the author, 1837,) which ended in death, the successful case of M. Davidson, (*Edinburgh Periodical and Surgical Journal*, Vol. LVIII., *Expér.*, t. II., p. 104,) then the four cases of M.

Fricke, (Godin, *Arch. Gén.*, 1837, t. XV., p. 187, 191,) and those which were collected by M. Sprengler, in 1836, 1837 and 1838, from the practice of M. Textor, we have, in admitting all those also mentioned by M. Coulon, (*Op. cit.*, p. 45,) an aggregate of about *sixty cases* of exsection of the elbow-joint, yielding more than *forty cures*, arranged as follows:—

In the cases complicated with Luxations or Fractures.

Wainman,	1.	}	Resulting fortunately.
Goorke,	1.		
Percy,—several.			
Dinus and Mazzoza,	1.		
Hey,	2.		
Evans,	1.	}	Doubtful.
Textor,	1.		
Warmuth,	1.		

In the cases of Caries.

Justamond,	1.	Jæger,	2.
Moreau, the father,	4.	Dietz,	1.
Moreau, the son,	1.	Kern,	1.
Champion,	1.	Moisisowitz,	1.
Dupuytren,	2.	Sanson,	1.
Park,	1.	Harris,	1.
Crampton,	2.	Warren,	1.—dead.
Delpech,	1.	Davidson,	1.
Roux,	6.—4 dead.	Fricke,	5.—1 dead.
Syme,	15.—5 dead.	Textor,	7.—4 dead.

So that it is impossible not to admit this operation at the present day, as among the number of the most valuable acquisitions of surgery, notwithstanding the contrary opinion of M. Larrey and my ancient preceptor M. Gouraud, who adopt it only in cases of fracture or comminuted luxation, with division of the integuments and protrusion, (issue,) of the bones. It is true that the destroyed parts do not seem capable of reproduction, as some persons in the beginning flattered themselves was the fact, and it is also true that the articulation at the elbow is almost always wanting. But there is, nevertheless, formed in their place, a substance sufficiently solid to serve as a point d'appui for the muscles, and to enable the forearm to make flexion and extension. The patients once cured, have always been enabled to make use of their hand, and have, as we have seen, deemed themselves exceedingly fortunate in not being obliged to undergo amputation of the arm, the only resource which would have been left them if exsection should not or could not have been attempted. The loss of substance also may be made to a great extent. Brun (*Mém. de l'Acad. des Sc. de Toulouse*, t. II., p. 38, 1784,) mentions a gun-shot wound at the articulation of the elbow, which

carried away the lower half of the humerus and upper half of the two bones of the fore-arm to the extent of *fourteen inches and a quarter* in the whole extent. The patient, who recovered with an interval of fifteen lines between the fragments, can make use, says the author, of his wrist, with which he raises a weight of forty pounds; but he cannot raise his hand to his head, except by sudden jerks, (*secousses*,) and by means of a vigorous contraction of the muscles which cover the shoulder: when the lower part of the arm has been carried up in this manner, his fingers act voluntarily.

ARTICLE IV.—PARTIAL EXSECTION OF THE ELBOW-JOINT. (Partielle du Coude.)

§ I.

If *one of the condyles* only or the olecranon was the seat of the disease, we should pursue the same plan which Moreau did on one occasion with success; that is, to make one of the lateral incisions above described; then to make from the lower extremity of the last mentioned, another incision transversely, which is to terminate above the olecranon about the middle of the breadth of the arm; to dissect and reverse from below upwards, to the median line of the limb, the triangular flap thus circumscribed; then by means of the chisel or gouge to destroy every portion of the bone which is diseased, and afterwards to adjust the flap (*bandeau*) in its place to unite by first intention. This partial excision which has been performed also by M. Fricke, and which I have made trial of on one occasion, would now require that we should detach the bone by means of the concave rowel saws, the osteotome of M. Heine, or the cutting pliers, should seem possible to respect the articulation, as in my case related a little farther back, (in this volume II.)

§ II.

The *Radius* only. A gun shot wound which happened in the year 1777, fractured the upper part of the radius; at the expiration of five weeks, inflammatory accidents supervened; the fractured portion is considered as a foreign body; *an erysipelatous state of the limb, and acute pains about the fracture, &c., lead to the proposition of amputation.* Salmon and La Flize, (Salmon, *De Artium Amputat. rarius admittenda*, § VIII., Nanceii, 1777,) oppose it, and the first named of these surgeons, detaches and removes the isolated portion of the radius, which was two inches in length. A cure was effected.

In 1796, says M. Champion, (Unpublished—Communicated by M. Champion.) I saw a surgeon of the most ordinary kind, remove an inch and a half from the humeral extremity of the radius, which had been wounded, (*coupée*,) and laid bare by a sabre cut, without implicating the articulation. The patient preserved the

movements of flexion and extension, but rotation was imperfect; he was enabled however to continue his profession of gendarme.

§ III.

The *Ulna* alone. A sequestrum of the olecranon was removed by means of the fingers by Le Dran, (*Obs. de Chir.*, t. I., p. 356; *Obs.* 51, 1731,) without the articulation being thereby injured. But a case in which Alanson, (Park, *Nouv. Méth. de traiter les Maladies*, p. 54,) removed a similar fragment, including the inner tuberosity, and a lamina of the body of the humerus, was followed by ankylosis. Jalabert, (*Journal sur toutes les Parties de l'Art de Guérir*, &c., p. 91, 1792,) has seen a case in which destruction of this eminence by caries was not followed by any inconveniences. In a patient of Ravaton, (*Chir. d'Armée*, *Obs.*, 66, p. 294,) the olecranon was carried away by a gun-shot wound. In that of Planque, (*Mém. de l'Acad. de Chir.*, t. II., p. 528, in 4to, t. VI., p. 241, in 12mo,) a portion of the external condyle of the humerus was carried away at the same time. Although in the case of De la Touche, (*Dissert. sur l'Amput.*, p. 56; *Obs.* 15, 1814,) there had been a simultaneous fracture of the two bones of the fore-arm, pronation and supination continued unimpaired, in spite of ankylosis of the elbow. In another case, the upper half of the olecranon was carried away by a sabre cut, and M. Larrey, (*Séance de la Sect. de Chir. de l'Acad. de Méd.*, 30th Sept. 1824,) as well as M. Baudens, (*Clinique des Plaies d'Armes-à-feu*, p. 452,) speak of olecranous fractured, and extracted without being followed by ankylosis.

The *olecranon* was exsected in a case of luxation of the elbow-joint backwards, rendered irreducible by the protrusion of this process through the skin. B. Bell, (*Cours Complet de Chirurgie*, t. VI., p. 141,) who was witness of the operation, is of opinion, that if the fore-arm had been flexed instead of being extended during the efforts at reduction, that the displacement could have been reduced, and the operation avoided. In a case of gun-shot wound, Bilguer, (*Dissert. sur l'Inutilité de l'Amput. des Membres*, § 36, p. 122,) extracted splinters, and exsected the ulna to the extent of four fingers' breadth, removing at the same time pieces of iron which were buried (*enchassés*,) in the parts, and cured his patient. [An interesting case of this kind occurred near this city, a few years since. A gentleman while out shooting, had his gun burst, and the fragments produced a lacerated wound near the bend of the arm. The country physician continued for months, in fact for near a year, to extract from the wound fragments of every description, bits of the coat sleeve, pieces of the wooden stock, barrel, &c.; never attempting to dilate the wound and look into the real condition of the mischief. The arm meanwhile was comparatively useless and rapidly withered. The patient came to town. Dr. Cheesman, a good operator, but one of those who rarely condescends to inform the world of the fruits of his experience, nevertheless did well here so far as regards the treatment.

He cut down and freely dilated the wound, and discovered two or three inches of a fragment of the gun barrel, which completely embraced the round anterior portion of the radius, we believe, fastened upon it like an outward semi cylindrical encasement. This being detached, the patient recovered perfectly. T.] According to M. Jæger, (Jæger, (*Op. cit.*, p. 6, No. 36.) Gorke, exsected the olecranon and four inches of the ulna in the year 1793. In the case of Justamond, (*Ancien Journ. de Méd.*, t. LXXXIV., p. 402, 1790. Jæger, says M. Velpeau, in stating that Justamond had removed the upper portion of the radius, is evidently mistaken. The same case is mentioned in Park, edit. of Jeffray, p. 55, 56,) the body of the humerus not having been implicated, the articulation was not exsected, but only the extremity of one of the bones of which it is composed; extension and flexion were nearly destroyed, but rotation continued unimpaired.

§ IV.—*The Humerus alone.*

The removal of the lower extremity of the humerus, which had been isolated by a fracture, and was complicated with wound, was performed by Hey, (*Practical Observations in Surgery*, p. 365, case 7,) in 1801; and by M. Champion, (unpublished, communicated by the author,) in 1816. In this case, though the trochlea and internal tuberosity had been removed, the cure was complete, with a restoration of the movements of the limb; in a case of M. Larrey, (*Acad. Royal de Méd.*, 11 Sept. 1828,) in which a condyle of the humerus was separated by a sabre cut, he confined himself merely to its extraction. In another case in which Hey (*Opér. cit.*, p. 367, case 8) removed the extremity of the humerus, which had been fractured an inch above its articular portion, he also effected a cure. In another case, Park, (Jeffray, *Cases of the Excision*, &c., 1806, p. 65,) after having exsected the upper fragment of the humerus, which had protruded through the skin, removed also the articular fragment of this bone and the apex of the olecranon. The motions of the limb were almost completely re-established. In a case of luxation in a child, the humerus, denuded of its periosteum, had protruded through the skin. Trye (*Ancien Jour. Méd.*, t. LXXXIV., p. 403) removed two and a half inches of it, including also the condyles, and effected a perfect cure. In a similar case, in which M. Champion (unpublished, communicated by the author) excised the bone with the two lower thirds of the cavity of the olecranon, the movements were restored perfectly. In a case mentioned by Ansiaux, (*Clin. Chir.*, p. 320, 2e édit., 1829,) an eschar from a burn was torn off by a fall, and left exposed the entire articulation of the elbow-joint; the olecranon by itself came away on the fiftieth day. Everything indicated that the humerus would soon be detached; the suppuration became abundant, and the patient wasted away. Exsection of the humerus was performed at an inch and a half above its articular surface, on the sixtieth day after the accident; the patient recovered, but with a permanent

flexion of the fore-arm, in consequence of the destruction of the tendon of the biceps from the burn; the movements of rotation however were sufficiently marked.

ARTICLE V.—THE SHOULDER.

In the year 1740, Thomas, a surgeon of Pézenas, published the case of a patient, in whom the head of a necrosed humerus had been successfully removed, (*extraite.*) A little later, Boucher, in his *Memoir on Wounds from Fire-arms*, demonstrated that the upper extremity of the humerus, shattered into splinters, might be removed without any very great difficulty, and without the patient being obliged to sacrifice his limb. The same doctrine was afterwards maintained by Percy, (*Eloge historique de Sabatier*, p. 813,) who exhibited nine cases of this exsection to Sabatier, and by M. Larrey, and almost all the surgeons of the army. On this subject, we may consult the thesis of M. Triaud, and that of M. Legrand.

As to those cases in which exsection was proposed by E. Platner, where the head of the humerus is the seat of an organic lesion, the operation has been performed by White, (*Cases in Surgery*, etc., 1770, p. 57,) David, Vigarous, (*Soc. Méd. d'Emulat.*, t. III., p. 396,) Moreau, the father, MM. Moreau, the son, (Moreau, 1803, 1816, p. 114,) C. Petit, Brulatour, Textor, (Coulon, *Op. cit.*, p. 43,) Wurtzer, (Coulon, p. 43,) Lassere, (*Arch. Gén. de Méd.*, 2e série, t. V., p. 156,) Buzairies, (*Journal des Connaiss. Méd.*, t. II., p. 109,) Reynard, (*Journ. des Progrès*, t. VII., p. 250,) Baudens, (*Clin. des Plaies d'Armes-à-Feu*), and others.

It is known, on the authority of Sabatier, that already, in 1789, a child exhibited to the Academy of Surgery, in his right hand, the scapular extremity of the humerus, of the same side which had been removed by the surgeon-major of the regiment of Berry. The cases of this kind, either successful or unfortunate, are almost innumerable. An instance of the loss of the upper extremity of the humerus, carried away by a ball, is related by Seeliger, (*Biblioth. Chirurg. du Nord*, par Rougemont, t. I., p. 156.) The patient operated upon by Ridewald and Camper, (Wachter, *De Articulis Extirpandis*, etc., p. 68, Groning, 1820,) in 1770, was amputated in order to cut off (pour aller au devant) the exhaustion caused by the suppuration, but nevertheless died. The head of the humerus, separated by a sabre cut, has been also extirpated by M. Larrey, (*Mém. de Chir. Milit.*, t. III., p. 27,) by Percy, (*Eloge de Sabatier*, p. 75, in 4to,) Chaussier, (*Mém. de la Soc. d'Emulat.*, p. 400, t. III., an VIII.,) by Roubieu, and another surgeon-major, (*Annal. Méd. de Montpellier*, p. 394, t. VIII.,) and by M. Yvan, (*Des Plaies d'Armes-à-Feu*, p. 17, 1805; *Thèse*, de Paris.) In the patient of Vigarous, (*Opusculs cités*, p. 106; *Œuvr. Chir. Prat.*, p. 431,)* in 1767, the same as in that of White, (*Trans. Phil.*, 1769,

* M. Vigarous, the son, says M. Velpeau, censures M. Champion for having said, (*Journ. de Méd. continué*, t. XXIII, p. 244,) that his father had not exsected the head of the humerus, but only extracted it, (*Œuvr. Chir. cit.*, p. 431, 1812.) The evidence

Vol. LIX., p. 39,) in 1769, the extraction of the dislocated head of the humerus became necessary, after the necrosed upper portion of the body of the bone had been exsected. For examples of cases wherein fragments composing a portion of the head of this bone have been extracted and removed, we are indebted to Geoffroy, whose case, related by Boucher, (*Mém. de l'Acad. de Chir.*, t. II., p. 299, in 4to; t. XII., p. 300,) is always cited under the name of this last author; also to Ravaton, (*Le Chirurg. d'Armée*, p. 267,) and to Chabert, (*Obs. de Chir.*, p. 156, 1724; he was afraid to amputate, says M. Velpeau,) who published, in 1721, a remarkable case of this kind; to Nicolas, the son, (*Manuel du Jeune Chirurgien*, p. 425; to Bourienne, (*Journal de Méd. de Dehorne*, t. I., p. 206, 1782,) who removed at the same operation, and in succession, the pieces of bone which had composed the upper portion of the humerus, as far as the insertion of the deltoid muscle; to Massot, (*Ibid.*, t. III., p. 362,) who took away a large number of splinters, (esquilles;) to Percy. (*Eloge de Sabatier*, in 4to, p. 83, en note; to M. Larrey, (*Relat. Hist. et Chirurg.*, etc, p. 310; *Mém. de Chir. Milit.*, t. II., p. 171,) who gives ten cases of this kind; to M. Yvan, (*De l'Amp. des Membres à la suite des Plaies d'Armes-à-Feu*, p. 19, 1805;) and to M. Arbey, (*Coup-d'Œil sur l'Amput. des Membres*, etc., p. 13, Strasbourg, 1805,) who speaks of the immediate and successive extraction of fragments which had formed the upper third of the humerus.

Disarticulation, with the removal of the head of the fractured humerus and exsection of the body of this bone, have also been performed by M. Champion, (Unpublished—communicated by the author.) In another case his nephew, M. Nève, (*Ibid.*) exsected a portion of the body of a fractured humerus, which had protruded through the skin, and become irreducible, and then disarticulated the head of the bone.

A case of exsection of the anterior half of the head of the humerus, notched by the passage of a ball, is also related by M. Baudens (*Clinique des Plaies d'Armes-à-feu*, p. 553, Paris, 1836;) and cases of the exsection of the head or of a portion of the body of the fractured humerus are also related by Grosbois (*Diss. sur l'Amput. du Bras dans l'Article*, p. 34, 1803,) Bottin, (*Hist. de l'Etat et des Progrès de la Chir. Milit.*, par Briot, p. 161, 1817,) Courville, (*Ibid.*) M. Willaume, (Jæger, *Op. cit.*, p. 3, Nos. 8 to 35,) and M. Guthrie, (Jæger, *id.*, No. 38,) and another English army surgeon, (*Ibid.*, No. 30.) A portion of the head of the humerus and of the clavicle and scapula were also removed by Morel, (*Medico-Chirurg. Trans.*, Vol. VII., p. 161;) but this case might be placed under the head of examples of caries resulting from comminuted fractures, and nothing shows that the cases of MM. Willaume, Guthrie and Textor, (Jæger, *Op. cit.*, p. 4, No. 47,) which last again performed this operation successfully in 1836, (Communicated by M. Sprengler, 1838,) belong to exsection rather than to extraction. In another case, related by M.

of this simple extraction, however, is contained in a paragraph in a letter from Vigarius, the father, to Sabatier, (*Mém. de l'Institut. Sciences Phys et Math.*) but which Vigarius, the son, was unacquainted with.

Baudens, (*Clinique des Plaies d'Armes-à-feu*, p. 550, 1836,) where the head of the humerus was fractured by a ball which remained unextracted at the bottom of the perforation, exsection having been performed, the end of the body of the bone was rasped and rounded off, (arrondi,) as recommended by M. Reynaud.

The case of Poret and Fayet is one of fracture from a fire-arm, with splinters and complete solution of continuity between the head and body, followed by a diffused callus uniting the two parts and accompanied with caries.

In cases of caries, exsection of the humerus has been performed by Lentin, (Jæger, *Op. cit.*, p. 3, No. 2,) Bent, (*Trans. Philosoph.*, Vol. LXIV., p. 353, 1774,) Orred, (*Ibid.*, Vol. LXIX., part 1, art. 2, p. 6, London, 1780, for the first case, and *Medical Commentaries*, &c., for the second; the operation in both cases was performed in 1779,) Moreau, the father, (*Obs. Prat. Relativ. à Rés. des Art. aff. de Carie*, by Moreau, the son, p. 79, 1803, and *Essai sur la Résect. des Os*, etc., p. 10, by the same,) David, the father, of Rouen, (*Inutilité de l'Amputat.*, etc., p. 55, Paris, 1830,) Poret and Fayet, (Briot, *De l'Etat et des Progrès de la Chir. Milit. en France*, p. 164,) Rossi, (*Méd. Opér.*, t. II., p. 233, 1806,) Moreau, the son, (*Essai sur la Résection*, pp. 14, 16, 27,) Textor (Jæger, *Op. cit.*, p. 4, No. 5,) Syme, (*Ouvrage cité*, pp. 51, 52, 58,) Jæger (*Op. cit.*, p. 4, No. 51) and Fricke, (*Ibid.*, No. 53.)

The indications for exsection of the head of the humerus are:—1, Comminuted fractures with wound of the integuments; 2, partial fractures in the thickness of the bone (épaisseur) with contusion and wound; 3, complete fractures of the bone with wound, and leaving only the cartilaginous head for the upper fragment; 4, complete fractures of the head of the humerus below its neck, with contusion (broiement) and wound; 5, fractures of the neck, with luxation of the head of the humerus unreduced, (Exsection (allation) proposed by Delpech, *Chir. Clin.*, t. I., p. 242,) and becoming protruded (devant être éliminées;) 6, necrosis; 7, caries and spina ventosa; 8, osteo-sarcoma; and 9, exostoses.

The process to be adopted in this operation must necessarily vary according to the morbid conditions.

§ I.—Process of White.

When the greater portion of the surrounding tissues are sound, or the bones are crushed into fragments, we may, after the example of White, M. Larrey and M. Portet, confine ourselves to one incision parallel with the fibres of the deltoid, reaching from the apex of the acromion to four or five inches below, and which penetrates down to the articulation, as in the process of Poyet for the removal of the arm. Then grasping the elbow with the whole of the hand, White made use of this [purchase] to give pendular (faire basculer) motions to the humerus from below upwards, and in order to luxate the head through the soft parts.

§ II.

M. *Larrey* causes the lips of this first incision to be held apart, opens into the fibrous capsule, and then divides by means of a blunt-pointed bistoury conducted upon the finger, the tendons of the supra-spinatus, infra-spinatus, sub-scapularis and teres minor muscles, in such manner as to remove every difficulty in bringing the head of the humerus to the exterior. When the operation is arrived to this point, a thick compress, or some protecting substance (quelque plaque protectrice) is glided between the neck of the bone and the integuments on the upper part of the arm, in order to saw the diseased portion, and thus exsect it.

§ III.—*Process of Moreau.*

Moreau remarked with reason that the simple incision recommended by White, even when combined with the modification of M. Larrey, would, in a majority of cases, be found insufficient. According to him, two incisions of four inches long, made, one on the anterior, the other on the posterior border of the arm, and united below the apex of the acromion by a transverse incision, would be infinitely preferable for forming a trapezoidal flap to be dissected and reversed upon its apex from above downwards or towards the insertion of the deltoid. By this means we lay bare all the anterior portion of the articulation. Nothing then is easier than the division of the capsule, and to bring to the exterior the head as well as the upper portion of the humerus, in order to make their exsection. The flap, then raised up on the wound, should be fastened above, and on the sides by a few points of suture.

§ IV.—*Process of Manne.*

Moreau's plan for exsection of the humerus is evidently easier than that of White; but the large flap which differs only from the deltoidal flap of La Faye, in being dissected and reversed at its base instead of detaching it at its apex, renders immediate reunion difficult, exposes to the formation of purulent openings, (clapiers,) which ought to be avoided, and should be adopted with scrupulous fidelity. It is better, in case the surgeon wishes to have a trapezoidal flap, to follow the advice of Manne, that is to make two lateral incisions, like Moreau, then unite them at their lower extremities, and dissect and raise up this flap from its point to its base, precisely in fact as La Faye advises for amputation of the arm at the shoulder-joint.

§ V.—*Process of Sabatier.*

In place of adopting so many precautions to preserve the soft parts, Sabatier formally advises to circumscribe the flap by a large

V incision, with its base above upon the tissues of the deltoid, then to *excise* out [that is, to cut out completely. T.] this triangle, in order to lay bare the articular capsule. It is difficult to comprehend what should have induced Sabatier into such a process, and why he should direct the removal of the flap in question rather than to preserve it. In restricting ourselves merely to raising it up as M. Gouraud did in 1801, and as M. Smith in America has also done, we may extract and exsect the bone with ease.

§ VI.—*Process of Bent.*

After having in vain endeavored to make trial of the process of White, Bent, who was one of the first to perform the operation of exsection of the humerus, believed it preferable to detach the fibres of the deltoid first outwardly, near the acromion, and then on the inner side at the clavicle and transversely, in such manner as to form a T incision, which enabled him to dissect two triangular flaps—the one on the outside, the other on the inside—whereby he could freely come down to the joint.

§ VII.—*Process of Morel.*

M. Morel, who was not satisfied with any of these methods, confined himself to the formation of a semilunar flap, with its convexity downwards upon the front of the shoulder. The operation was long, but his patient recovered.

§ VIII.

M. Syme, who has twice exsected the humerus successfully, cuts his flap on the outer half of the deltoid, and gives it the form of a triangle, the anterior branch of which corresponds to the incision of White, while the other, which is much shorter, passes obliquely from below upwards and backwards towards the spine of the scapula. This surgeon, after having raised up this flap, brings the elbow in front of the thorax; divides the capsule; luxates the head of the humerus; excises it; brings down the flap, and proceeds to the dressing.

§ IX.—*Process of M. Robert.*

The modification proposed by M. Robert, consists in an incision which sets out from the anterior border of the clavicle, at two fingers' breadth from its outer extremity, and which is then carried, in a direction parallel to the axis of the arm, to the anterior part of the stump (*moignon*) of the shoulder. The bistoury being directed to the middle of the acromio-coracoid space, divides transversely the ligament of the same name, and thus enables us to arrive directly down upon the articulation. Thus modified, the

operation has the advantage of rendering the disarticulation more easy, and also of enabling us to avoid the circumflex nerve.

§ X.

Finally, exsection of the humerus is performed by *two principal methods*, viz.: methods or processes of necessity, and those of election. A single vertical incision, placed towards the outside, suffices for Vigarous, White, Orred, MM. Larrey, Rossi, Baudens, (*Clin. des Plaies d'Armes-à-Feu*, p. 551, 1e opéré,) and Thomas. MM. Robert and Malgaigne, who bring down this incision from the apex of the coraco-clavicular triangle, prefer placing it in front. It is this incision in front which M. Baudens (*Ibid.*, p. 555, 2e opéré) transforms into a T, by dividing the incision into the deltoid muscle, to the extent of ten lines on each side, without implicating the skin. With him the vertical incision commences on the outside of the coracoid process, and is continued through the furrow, (*sillon*), which divides the pectoralis major muscle from the deltoid.

A single angular flap, horizontal or lateral and above or in front, was preferred by M. Nève, (unpublished case, communicated by M. Champion,) on account of the situation of the wound and the protrusion (issue) of the lower fragment of the fracture. M. Champion, (*Ibid.*) in another case, cut a horizontal angular flap above and behind, on account of the situation of the gun-shot wound. The incisions then represent a 7, or nearly so, and implicate, by their horizontal branch, the fibres of the upper insertion of the deltoid. The two angular flaps, with the simple T incision, constitute the process of Bent, while the two flaps resulting from the T inverted, or a species of anchor, represent the process of Bromfield, (*Chir. Observations & Cases*, vol. I., p. 300, and plate 3, 1773.) A single vertical flap outside, pyramidal, reversed, or in V, comprises the process of Sabatier, and those of Briot, (*Histoire de la Progrès de la Chirurgie Militaire en France*, p. 164, 1817,) Poret, Fayet, (*Journal Méd. contin.*, t. XXII., p. 485, 1811,)* Gouraud, Smith, and Syme, (page 50 and planche 5, fig. 1.)

A single outer vertical flap, trapezoidal or quadrilateral, with its base downwards, characterizes the process of Moreau, the father, (*Observations Pratiques Relatives à la Résection*, p. 79,) while this flap, in the process of Moreau the son, (*Essai sur l'Emploi de la Résect.*, etc., p. 16,) has its base above. If terminated by a lower border, which is rounded off or buckler-shaped, (*en rondache*), it forms the process of Morel, (*Medico-Chirurgical Transactions*, vol. VII., p. 161.)

§ XI.—Appreciation.

The diseases which indicate exsection of the humerus, are the

* Poret and Fayet, says M. Velpeau, whose names are mis-spelt by Briot, and their case misunderstood by M. Gouraud, in reality exsected the upper extremity and head of the humerus, which had been fractured, and then become reunited by a diffused callus.

same as those for which disarticulation of the arm was formerly performed; consequently, the different operative processes employed for this last are applicable to exsection. Thus, in place of cutting out a flap by three incisions, as La Faye did, it is much more simple to imitate Morel, and to form it with a single incision, like Dupuytren, or even to adopt the process of M. Onsenort. It is, moreover, manifest that exsection differs from amputation of the arm at the articulation, only in the last stage of the operation.

A. We may, therefore, adopt sometimes one process and sometimes another, according as it shall seem more easy to isolate the head of the humerus by penetrating from above downwards, or from the outer towards the inner side, or in any other manner, and according also as the integuments and muscles shall be more or less altered in one direction than in another. M. Guthrie recommends that, in whatever manner the operation is performed, we should remove as much of the articular capsule as possible, because, says he, the more of this fibrous pouch we leave behind, the less chance will there be of obtaining a free, immediate reunion. This practice, though proper to be adopted in cases of amputation, is not suitable to exsections, because, in these last cases, the limb will have so much the better chance of recovering its strength and steadiness, (*fixité*,) in proportion to the greater quantity of fibrous tissues preserved.

B. As soon as the extremity of the humerus is removed, we examine into the condition of the acromion, the coracoid process, and the glenoid cavity of the scapula. If these different parts are not changed, we proceed at once to the dressing; in the contrary case, they are to be removed with the cutting pliers, the gouge, chisel, or saw, in the manner described for the removal of the arm; that is to say, if the degeneration of the bones extends to a certain distance, it will become necessary to prolong backwards, under the spine of the scapula and upon the inner side of the coracoid process, the incisions which circumscribe the base of the flap, in order to lay bare the whole extent of the diseased parts. It is known, also, that, in a case of this kind, M. Larrey did not hesitate to remove the three processes just mentioned, together with the acromial extremity of the scapula. M. H. Hunt adopted the same course in a patient in whom M. Brown had already removed the head of the humerus, in 1818. It is also known that this bold step was crowned with complete success.

C. Moreau had this excision of the scapula in view, when he recommended to reverse the deltoid from above downwards. In that case nothing would prevent our forming another flap in an opposite direction, which would render the removal of the processes of the scapula an easy matter. But as it will always be possible if we cut the flap in the manner of La Faye and Dupuytren, to preserve a sufficient degree of thickness at its root to prevent its mortification, the motive which influenced Moreau, is not of importance enough to permit us to adopt his views.

D. The exsection being terminated, we replace the extremity of

the body of the humerus into the wound, thus again giving to the arm its natural direction. Whatever may be the form of the flap, the lips of the wound are to be accurately brought together, except only at its most depending angle. In order to keep the edges in contact we are to apply to the root of the limb, pieces of agaric, gateaux of lint, or graduated compresses. A bandage with separate bandelettes, (vid. Vol. I.,) cushions, splints, or better still the starch bandage, will maintain the whole in such manner as to enable us to dress the wound as often as we judge it convenient to do so, [See notes above on the use of the *starch bandage*, where the articulations are implicated. T.]

E. Some persons have imagined that the portion of the bone removed, might be reproduced. In the case of Chaussier, (*Mém. de la Soc. Méd. d'Emul.*, t. III., p. 400,) it is seen that an osseous conical-shaped mass filled up the glenoid cavity, and ultimately it is true, placed itself in relation with the upper extremity of the body of the humerus, which had become slightly excavated, and thus actually produced a new articulation, and enabled the arm to execute almost all its movements. In one of the cases related by Moreau, the upper part of the humerus was drawn to, and fixed against the chest, where a sort of accidental articulation was ultimately established. But nothing in these two facts bears any resemblance to a reproduction of the bones, and most usually the upper extremity of the humerus remains movable in the midst of the muscular tissues, (*les chairs*.) In the patient of M. Yvan, (*Arch. Gén. de Méd.*, 2e sér., t. XIX., p. 619,) or that of M. Cloquet, there was no osseous reproduction in front of the shoulder. In the suggestion of M. H. Roux, (*Rév. Méd.*, 1835, t. IV., p. 389,) that we should excise the humerus by a curved section, so as to obtain a sort of head which can accommodate itself to the glenoid cavity, he has not reflected that the arm-bone and scapula after the operation are no longer in contact.

F. The patient, nevertheless, most usually retains the movements of his fingers, hand and fore-arm. He may even be enabled to raise the whole limb to a certain extent in all directions ; but it will not be possible for him to raise it either to a right angle to the trunk, or to separate it to any considerable distance from the chest. It remains therefore infirm, (*infirm*), after an operation of this kind ; but it is much better to have an imperfect limb, which can execute only a part of its functions, than to have none at all, and the last cases reported by M. Syme, conclusively demonstrate, that the uses of the arm in these exsections, may sometimes be almost completely re-established.

§ XII.

This is an operation moreover which exposes to almost as many immediate or consecutive dangers as disarticulation of the arm: the patient of Vigaroux died from the effects of it. Other fatal terminations have been passed over in silence by authors.

De la Touche, (*Dissertation sur l'Amput. dans les Fractures des Articul.*, p. 34, Strash., 1814,) does not know what was the result of the case he speaks of. Grosbois, (*Dissert. sur l'Amput. du Bras dans l'Article*, p. 34, 1803,) is in the same predicament. The two cases of Vernet, (*Lettre Autographe de Vernet*, 1816, Bayeux,) former surgeon in chief of the armies, terminated fatally. The three operated upon by Delpech died between the sixth and ninth days, in consequence of spasmodic accidents. Two also operated upon by Legrand, (*Dissert. sur la Résection de la Tête de l'Humerus*, p. 9, 1814,) died from tetanus. Two also that were operated upon by surgeons of the English army, likewise perished, (Jæger, *Op. cit.*, p. 41, Nos. 40—41.) M. Baudens, (*Gaz. Méd.*, t. VI., p. 425, 1838,) lost one from secondary hemorrhage, and two from cholera, at the moment when the cure was going on well.

In a patient of Moreau, the father, (*Essai sur l'Emploi de la Résection*, par Moreau, fils, p. 18,) the caries after the operation extended to the body of the bone. In a case of Briot, (*Histoire de l'Etat de la Chir. Mil. en France*, p. 164, 1817,) the caries was followed by a fistula, the result of which is not known. M. Jæger, (*Op. cit.*, p. 4, No. 52,) cites a case where amputation became necessary in consequence of necrosis of the medullary canal. In a case mentioned by Knox, (*Edinburgh Medical and Surgical Journal*, t. XVIII., p. 62,) the condition of the parts after exsection had been performed, made it also necessary to have recourse to amputation.

A surgeon who divided the brachial artery, during the operation, immediately resorted to amputation of the limb. (This operation says M. Velpeau, was made in presence of a physician who communicated the fact to M. Champion.) A case in which M. Roux, (*Mélang. de Chir. et de Physiol.*, p. 240, 1809,) had exsected the head of the humerus, and rasped and cauterized the glenoid cavity, without reuniting the wound, also ended fatally. In the case mentioned by M. Gouraud, (*Demonstr. des Principes, Oper. Chir.*, p. 178,) the operation was undertaken, when the patient was in a condition which should have deterred the surgeon from performing it. One of the cases cured by M. Syme, (*Ouvrage cité*, p. 58,) afterwards died of phthisis. In the greater number of cases however, the cure has been complete, as in the case operated upon by M. Textor in 1836. It seems just also to distinguish the cases of death consequent upon the operation, from those that had no connection whatever with it.

ARTICLE VI.—THE CLAVICLE.

The clavicle, it is true, is situated very superficially, but as it rests posteriorly and below against organs, the wounding of which would be extremely dangerous, surgeons have scarcely dared to undertake its exsection. Nevertheless, circumstances may occur, and these frequently, which seem to demand this operation, unless we wish to abandon the patient to certain death. Sometimes the disease is confined only to the outer extremity of the clavicle, in

other cases situated upon its sternal extremity, or in its middle portion, or it may even occupy the whole extent of the bone.

The removal of a sequestrum of the diaphysis or body of the clavicle, and which was followed by regeneration or reproduction of the bone, was performed by Moreau and Dangerville, (*Mém. de l'Acad. de Chir.*, t. V., p. 361, in 4to; t. XIV., p. 160, in 12mo,) also by Bayès, (Brun, *Mém. de l'Acad. de Toulouse*, t. I., pl. 1, fig. 1, et 2. *Lettre d'un Elève en Chirurg. de l'Hôtel Dieu de Toulouse*, 16 Août, 1792, p. 16,) Otto de Weissenfels, (*Gaz. Méd. Nat. pour l'Allemagne*, No. 46, 1798,) and by Pelletan, the father, (Champion, *Convers. à l'Hôtel-Dieu*, 1802,) who stated in 1802, that he had extracted the clavicle *entière* (tout entière) in a child in whom this bone was *necrosed* in consequence of an abscess supervening during small-pox, and which was then afterwards reproduced. [The passage is a little obscure: "qui (*i. e.*, Pelletan, père,) racontait en 1802 avoir *extrait* la clavicule *tout entière* à un enfant chez lequel cet os, *nécrosé* par suite d'un dépôt survenu pendant la variole, s'était reproduit." Some might think that M. Velpeau, whose text it is, (Vol. II., p. 715, edit., Paris, 1839,) means that the *reproduced* bone, *necrosed* after its reproduction, was the one extracted. It means, without doubt, however, that the *necrosed* bone, comprising, as Pelletan says, the *whole clavicle*, was extracted after having been thus previously destroyed by an abscess consequent upon small-pox—nature herself, in fact, performing the principal part of the operation; and that the bone was afterwards reproduced. T.]

Pezoldi, (*Obs. Méd.-Chir.*, etc., C. Pezoldi, p. 126,) who wrote in 1715, thus speaks of a case of exsection of the clavicle: Necrosis, the consequence of abscess; incision; dilatation with a sponge; the clavicle fractured or separated on one side; exsection by means of a cutting forceps, of the greatest portion of the bone; extraction of one or two splinters, six days after. The child aged nine years, recovered perfectly, and could use its arm as before. A reparation took place of the loss of substance, (F. Cosme D'Armbruste, in Pezoldi, *Obs. Méd.-Chir.*, etc., obs. 62, p. 126, 1715.)

In the case of Kulm, (*De Exostosi Steatomode Claviculæ*, Dantzick, 1732,) the osteo-steatoma or tumor, a foot in length, four inches in breadth, and two feet in circumference, and extending from the clavicle to the mamma on the same side, weighed five pounds. Morgagni (*De Sed. et Caus. Morb.*, epist. L., § 58) speaks of an exostosis of the clavicle, which he declared could not be cured without the intervention of the saw, an operation which the feebleness of the little patient was not able to sustain.

The mode by which this bone should be excised or extirpated, is a difficult matter to describe, seeing that the disease which might make it necessary always causes extensive alterations in the anatomical arrangement of the surrounding parts.

§ I.—The Acromial Extremity.

In 1828, in the case of a woman who had been for a long time

affected with necrosis in the outer third of the clavicle, I first made a crucial incision, the two incisions (*les deux branches*) composing which, were each about four inches in length. After dissecting and reversing the flaps, keeping them apart, and dividing the acromio-clavicular ligaments, and some bundles of fibres of the origins of the deltoid and trapezius muscles, I was enabled, by means of a piece of wood inserted into the articulation as a lever, to raise up the diseased bone, and to detach it in this manner from the sound parts. If it had offered too much resistance, a hand-saw, or better still, a crested saw, would have sufficed to effect its exsection from above downwards, or from before backwards. Supposing it should be buried too deep [to do this,] it would be necessary to isolate it carefully from the soft parts, in front and behind, and then to introduce under its lower surface a chain-saw, dividing the bone from behind forwards, and afterwards disarticulating and removing it."

If the skin should not be ulcerated, nor even actually diseased, we might succeed equally well or even better, I think, by cutting a triangular flap, by means of an incision parallel to the anterior border of the clavicle, which incision should be prolonged as far as the apex of the acromion; then another much shorter, which should fall at a right angle upon the outer extremity of the first. The flap being reversed backwards would lay bare the diseased bone completely, enable us to apply the saw upon the sound portion, and afterwards to detach the fragment by means of a strong pair of forceps or the elevator. It would also enable us to excise the corresponding border of the acromion, should the disease have extended to that part. The rowel saw, and M. Heine's osteotome, or M. Liston's sector, should the patient be young, would at the present day render the division of the clavicle in such cases a very easy matter. M. Roux informs me that he has also, in one instance, performed this operation, and with success.

§ II.—*The Sternal Extremity.*

Since M. Wurtzer (*Jæger, Op. cil.*, etc., p. 3) set the example, the exsection of the inner extremity of the clavicle has been performed in a number of instances. The most curious case we have of this kind, and which is anterior to that of Wurtzer, belongs to Davie, (*S. Cooper, Dict. de Chir.*, t. II., p. 104.) A deviation of the spine had depressed (*déjeté*) the head of the clavicle towards the œsophagus in such manner that the young girl could not swallow. Davie made an incision of two to three inches in length along the depressed bone, and then in order to exsect it, made use of the turning (*versatile*) saw of Scultetus. An incision in L, the short branch of which should ascend vertically from the sternum to the trachea, would answer better. A triangular flap would result from this, which, being raised upon the neck, would lay bare the articulation with the inner third or half of the clavicle, which should then be divided, and detached from without inwards. This process would be of more easy application than the preceding to the sternal half

of the clavicle; but whether it be at one extremity or the other, the operation is rendered so much the more delicate and dangerous, in proportion as the saw is to approximate nearer to the middle portion of the bone, because of its neighborhood then to the axillary vessels.

§ III.—*Extirpation.*

In the dead body the clavicle is extirpated without difficulty. An incision parallel to its cutaneous border, and which extends a little beyond its extremities, will ordinarily answer for this purpose. Or we may make two other vertical incisions of one to two incisions in length, one on the outside, the other on the inside of the first incision, the flap resulting from which divisions, on being raised up, completely lays bare the bone. We then disarticulate either the sternal or acromial extremity, and grasp it with the left hand in order to raise it up, while with the right, we detach with the bistoury the adhesions upon its lower border, (*face inférieure.*) We might also saw the bone through its middle, and remove the two halves separately. When the bone is in a state of disease, this operation must be one of the most difficult in surgery. Notwithstanding which, it was performed with entire success by M. Mott, on the 17th of June, 1827, for osteo-sarcoma in a young man aged nineteen years.

The tumor was double the size of the fist, and extended in one direction to near the angle of the lower jaw and os hyoides, and in the other to the stump of the shoulder and the sterno-clavicular articulation. The author in his letter to me, September 2d, 1838, says: "It is the most important and most difficult of all the operations I have ever performed." More than forty ligatures had to be applied before it was finished.

M. Mott commenced by a semilunar incision with its convexity downwards, and extending from one extremity of the clavicle to the other, as if to detach the tumor from below upwards; he then made a second incision above, reaching from the acromion to the external jugular vein, divided the platysma myoides and a portion of the trapezius, introduced a grooved director, and then, by means of an eyed probe, (*sonde,*) passed the chain-saw under the clavicle, and divided it a little nearer the acromion than the coracoid process.

Being still unable to turn back the morbid mass, the operator united, by a third incision, the sternal extremity of the first with the second, tied the external jugular at two points, and divided the vessel on the internal, divided also, the outer portion of the sterno-mastoid muscle at two inches above its origin, and turned it down upon the sternum; was then enabled to push aside the omo-hyoideus muscle upwards and backwards, and was obliged to tie and divide also the internal jugular, and to separate, with great difficulty, by means of cuts of the bistoury or the handle of a scalpel, the sub-clavian vein, and even the thoracic duct from the degenerated tis-

sues; numerous branches, coming, doubtless, from the inferior thyroid, transverse cervical, supra-scapularis, aeromial, and other arteries, were also tied in succession as they were divided.

A last incision, the utility of which I cannot well understand, and which sat out from the first, was made in the track of the fourth rib, in order to divide the fibres of the pectoralis major muscle. After having divided the costo-clavicular ligament and the sub-clavius muscle, M. Mott was finally enabled to remove the whole tumor, and to finish the operation by disarticulating the sternal extremity of the clavicle.

The wound was filled with lint, after which, long strips of adhesive plaster maintained its edges as closely approximated as possible. No serious accident supervened. The cure was nearly completed by the end of July, and by means of an appropriate apparatus, which in some measure replaces the clavicle, the patient retains almost all the uses of his arm.

As an operation of this description ought not to be undertaken except by surgeons of consummate ability, (*des praticiens consommés*;) it is unnecessary, as I think, to enter into any detail in order to show in what particulars the process of M. Mott might be advantageously modified. Any person may comprehend this matter without difficulty, by recalling to mind the anatomical relations of the region affected, and will thus be enabled to conform himself to the special exigencies of the case. Thus, Beauchêne, who was obliged to remove a great portion of this bone and the remainder of the shoulder, deemed it advisable to adopt other incisions than those of M. Mott. Kulm, (*Thèse, Chir. de Haller*, trad., t. III.) who appears to have also made the extraction [*l'extraction*—see note a little farther back. T.] of the clavicle, at the beginning of the last century, equally found himself under the necessity of adopting a process for himself. I do not see, moreover, why the ligature *en masse*, so much extolled by M. Mayor, might not then be advantageously had recourse to by the surgeon, as soon as he has found that the hemorrhage cannot be prevented without a great deal of difficulty.

The patient in whom M. Warren, (*On Tumors, &c.*, p. 148,) had removed the clavicle by means of a crucial incision, died a month after. M. Travers, (*Journ. des Connaiss. Méd.*, 1838, p. 181,) on the contrary, who, in a young girl, aged ten years, extirpated the clavicle entire with the exception of its sternal head, states that he effected the cure of his patient. M. Roux, who also performed the same operation, leaving behind only the inner extremity of the bone, informs me that he was equally fortunate. In conclusion, it would seem, upon the whole, that the quadrangular flap which I have spoken of, would render the operation easier than by the different incisions of M. Mott.

§ IV.—*Exsection of the Scapula.*

The operation of exsection of the body of the scapula, also, would vary still more than that for the clavicle.

M. Janson, (*Arch. Gén. de Méd.*, t. XII., p. 414,) who has performed it, commenced by circumscribing the tumor by means of two semi-elliptical incisions, while preserving as much of the skin as possible; he then dissected and reversed upon their external surface the two lips of the wound; and detached the morbid mass in every direction down to the fossa sub-scapularis; but while he was raising it up in order to bring it forwards, it broke at its middle, and compelled him to separate at first only its outer half. After having divided the attachments of the trapezius, supra-spinatus and infra-spinatus muscles, the operator, discovering that the portion of the scapula situated above its spine was sound, separated, by means of the saw, the whole of the diseased bone, and thus preserved the articulation of the arm. By means of a last incision directed obliquely from below upwards, from behind forwards, and from without inwards, he laid bare the rest of the tumor; dissected it with care; drew it cautiously upwards; felt the cellular tissue which had attached it to the arm giving way, and finally detached the mass completely. All the vessels were tied. The bottom of the axilla was tamponed, and the lips of the wound, which was six inches in its transverse diameter and nine inches from above downwards, were brought together by means of adhesive plasters. The motions of the arm upon the glenoid cavity were preserved. The tumor weighed eight pounds and a half, was easily torn, and in its interior resembled a pomegranate.

Faure, (*Mém. de l'Acad. de Chir.*, t. VI., p. 114,) after amputating the arm, exsected the acromion on account of some irregular asperities upon it, and Frater, (S. Cooper, *Dict. Chir.*, t. I., p. 92, col. 1,) also advises this operation, which is disapproved of by M. S. Cooper, (*Ibid.*) Laisne, (*Journ. Gén. de Méd.*, t. VIII., p. 401,) removed in this manner a sequestrum from the glenoid angle, on the seventy-first day after the wound. In a case mentioned by Despelettes, (*Mém. de l'Acad. de Chir.*, t. II., p. 552, in 4to, et édit. in 12mo, t. VI., p. 247,) and where the shoulder had been carried away by a gun-shot wound, there remained nothing but the anterior angle, yet the patient recovered. In the patient of Halliday, (S. Cooper, *Dict. de Chir.*, t. II., p. 292,) which was seen by M. S. Cooper, though the shoulder was in great part destroyed, and the lung and pericardium exposed, the patient recovered notwithstanding. In the case of Borel, (Bonet, *Corps. de Méd.*, t. IV., p. 84, obs. 49,) the two shoulder-blades had been carried away by a musket-shot. Bond, (*Méd. and Phys. Journal*, Aug., 1821, Vol. LXVI., No. 270,) having seen a suspected case of osteo-sarcoma in the scapula, asks the question, if the patient's life could not have been saved by the removal of the bone? Mareschal, (*Mém. de l'Acad. de Chir.*, t. II., p. 60, in 4to,) applied the trephine to the scapula, in

a case of abscess between that bone and the ribs. A ball was buried in the middle of the infra-spinous fossa; M. Champion placed the trephine by the side of the ball, and succeeded. Else, (Sprengel, *Hist. de la Méd.*, t. VII., p. 33,) trephined the shoulder in a case of caries. Exsection of the lower angle of the scapula, was performed also by MM. Sommeiller and Champion, (Champion, *Thèse de l'Ecole de Paris*, No. 11, 1815,) which latter, in another case, excised the inner half of the spine of the same bone. Haymann, removed the greater part of the bone for an osteo-sarcoma; but the disease returned at the end of a year, and ended fatally. In the case of Luke, as well as that of M. Castara, (communicated by the author, Dec. 1, 1838,) the greater part of the shoulder had been invaded by a medullary fungus.

Ravaton (*Chir. d'Armée*, p. 249, obs. 52, 1768) speaks of the two lower thirds of the scapula, together with its acromion and spine, fractured by a gun-shot wound, and which had separated successively. Both in the case of Riolan (*Manuel Anat., et Collect. Acad.*, part. Etrang., p. X,) and in that of Chopart, (*De Necrosi Ossium*, p. 7, 1776,) a reproduction took place after a sequestrum in the scapula was removed. After a comminuted fracture of the scapula and clavicle, from gun-shot wound, mentioned by Monbalon, (*Gazette Salulaire*, 1764, No. 50, p. 2, col. 2,) it became necessary to extract four fragments of the first-mentioned bone, one of which fragments, and which was of considerable size, belonged to its spine. The fifth and largest fragment could not be taken away until the fifteenth day. Two large pieces of the clavicle had to be removed at a little later period, and the patient recovered.

CHAPTER II.

ABDOMINAL EXTREMITIES.

Though it may be difficult at the present day to question the advantages of exsection as applied to the thoracic extremities, it is not altogether the same in respect to the pelvic limbs. Here the artificial limb fulfils almost all the functions of that which has been amputated. In the upper extremities, on the contrary, no apparatus can be so adapted as to render any real service to the patient; [See an exception to this remark in our notes on *artificial arms*, supra. T.] however deformed the rest of the arm may be, in whatever state the hand may be, so long as they are saved, it is always possible to derive advantage from them, in a variety of circumstances. Nevertheless, exsection has been advised and often performed for all the articulations of the lower limb, as well as for those of the upper.

ARTICLE I.—FOOT.

Having treated of exsection of the body of the bones of the foot in another article, I will not re-enter into the details of this subject; for so much the greater reason, that it is subjected to the same rules as those of the bones of the hand. I will add only a few words on their extraction, and on the excision of their head.

Already, in the *Encyclopédie Chirurgicale*, (*Encyclop. Méth.*, part. Chir., t. I., p. 107,) on the subject of caries of the bones of the foot, we read this remarkable passage: “It ought to be laid down, as a general rule, that we should never amputate any parts except those that are in a state of disease, even if there should remain but two sound bones in the whole foot; for, by means of a shoe, properly arranged and with a strong sole, a very small part of the foot may become exceedingly useful, especially where it is the bones of the inner side which remain; that is to say, those which correspond to the great toe, and those which are the nearest to these.

“If the disease is situated in the middle of the foot, and the bones of the metatarsus on each side are in a sound state, (*bon état*,) these are not to be touched; we must confine ourselves to removing the bones affected, separating them at their articulations, whether they be diseased throughout their substance, or only in one portion of it; for though it might not be impossible to contrive instruments by which we might cut through a single bone in the middle of the foot, this operation would be much longer and much more painful than the incision of a bone made in its articulations, (*jointures*;) there would not, moreover, be any great advantage to hope for in preserving only one of its extremities. But when there are one, or two, or three bones affected on either side of the foot, as it is advisable to save as much of this organ as possible, we must endeavor to save the bones in a sound portion, and as near as possible to the part diseased.” Here have we clearly the whole doctrine of the moderns.

§ I.—*The First Metatarsal.*

A lady, in the year 1761, attacked with caries in the first bone of the metatarsus, lost by piecemeal the whole of this bone, except the posterior epiphysis, which remained. There was no reproduction; the action of the muscles brought the phalanx towards the epiphysis, but the patient limped as much after as before the cure. This circumstance induced Lalouette (*Tr. du Scrophule*, t. II., p. 20 et 36) to place a blade of steel in the sole (*entre les semelles*) of this lady's shoe; this was done so successfully that she was enabled to walk as firmly upon this foot as upon the other. M. Larrey (*Clin. Chir.*, t. III., p. 476) had an idea similar to this, since he proposed to remedy the void left in the foot of a hussar, by means of an elastic sole, (*semelle*.) Complete luxation of the first metatarsal bone, separated from the first cuneiform bone and placed

perpendicularly, rendered its extirpation in another case more easy than in that of M. Barbier. M. Bell (*Cours de Chir.*, t. V, p. 314) performed this extirpation for case of *exostosis* or *osteo-sarcoma*. M. Arbey (*Coup-d'Œil sur l'Amput. des Membres*, etc., p. 11-12, Strasb., 1805) states that, having removed the first metacarpal bone in a state of caries, there resulted from it a proportional shortening of the finger, at the root of which nothing was perceived but a slight cicatrix.

The disarticulation of the first bone of the metatarsus was also performed by M. Barbier, in the year 1795. Not being able to reduce its luxation, this surgeon decided upon removing it, while preserving, at the same time, the great toe. Beaufile, (*Mém. de la Soc. Méd. d'Emul.*, t. X., p. 218,) who published the case in 1797, says the patient was completely cured at the expiration of forty days. M. Pétrequin also (*Gaz. Méd. de Paris*, 1837, p. 36,) says that Monro had already performed the same operation successfully for caries. M. Blandin (*Biblioth. Méd.*, 1827, t. I., p. 458) has been no less fortunate since. A young man, upon whom I operated in this manner in 1833, at the hospital of La Pitié, also recovered perfectly. The case of M. Lisfranc (Pétrequin, *Gaz. Méd.*, 1837, p. 36) had an exostosis only, and the angioleucite and abscesses which supervened, did not prevent his recovery.

It appears to me, however, that we deceive ourselves upon this subject; after the extraction of the first metatarsal bone, the deformity in reality is greater than after its simple amputation; the toe is liable to be turned inwards, and to change its position and interfere with the uses of the foot. Drawn backwards by the cicatrix, and supported only on merely soft parts, it floats about like an inert appendage, (*doigt inerte*,) incapable of any use in standing. On the other hand, it is incorrect to say that ordinary amputation is habitually followed by reversion of the foot. It is an accident which doubtless may be met with, but very often does not happen. Authors abound in facts in support of this proposition. The first evidence I had of it was in 1829, at the hospital of Saint-Antoine. I amputated in the usual way; the patient was cured promptly; I have seen him many times since his recovery; he walks continually, and does not even take the pains to support his shoe on its inner side. I have since seen two other instances at La Pitié and five at La Charité. The same result took place in the patient of M. Philips, (*Bull. de la Soc. de Gand*, t. II., 229.) Therefore, it would be prudent to wait for more facts, before asserting that the extraction of the first metatarsal bone ought to be preferred to its amputation. This operation, moreover, appears to have been clearly pointed out by Hey, of Leeds: "When the caries is limited to the metatarsal bone of the great toe, it is usual, says this practitioner, after making a longitudinal and then a transverse incision, to remove its diseased portion with the saw. But, as it is sometimes difficult to recognize exactly the extent of the caries, I think it more advantageous to separate the totality of the bone at its articulation with the first cuneiform bone." If the evulsion of the bones of the metacarpus has met with general approval, it is be-

cause, in preserving the fingers, it alters but in a very slight degree the form and important uses of the hand; while in the foot we cannot count on the same advantages, nor on the same results. We should operate, moreover, by the same processes, unless some complication should force us to adopt the course of M. Barbier. At present, also, the process has many modifications. We either excise or disarticulate this bone.

The *disarticulation* of the first bone of the metatarsus is sufficiently difficult. By the *ordinary process*, we make an incision into the soft parts extending from the scaphoid bone to the dorsum of the first phalanx of the great toe, which we in the first place disarticulate. Then causing the lips of the wound to be separated and the extensor tendon to be pushed aside, the surgeon detaches, draws towards him, luxates and raises the head of the bone, isolates it upon its sides by means of the bistoury, and finally separates it from the first cuneiform bone behind. For myself, I have found it more convenient, after the first incision is made, to divide the bone in the middle by the chain-saw, and afterwards to extract its two halves separately. [We here again perceive (see note farther back) that M. Velpeau sanctions the basis which M. Chassaignac has for several years adopted for exsections of the long bones in every part of the body; *i. e.*, always to make the exsection some where in the continuity *first*, in order to facilitate disarticulation of one or both extremities, should such an operation be required. Thus in the jaw, metacarpus, metatarsus, &c. See note on this subject at the conclusion of this volume. T.] In whatever way it is done, there will be left a considerable void which the cicatrix never completely fills up. No reproduction need be hoped for; hence the extreme mobility of the toe which has been preserved.

Excision has not this inconvenience. If it is made only in the body of the bone, as in the patient of M. McFarlan, (*Arch. Gén. de Méd.*, 3e série,) there is a chance that the void (*échancrure*) may be filled up. In the supposition that it may be necessary to remove also its anterior extremity, the operation besides being much easier, would enable the toe to obtain ultimately a point d'appui behind. The extirpation of the entire metatarso-phalangeal articulation which has been performed several times successfully by M. Fricke, (*Ibid.*, 1837, t. II., p. 187—208,) would still be preferable to the total removal of the first bone of the metatarsus.

A quadrilateral flap with its base posteriorly, was first proposed by M. Blandin for these cases. It would seem also that a \cap incision placed horizontally and looking forwards (*couché en avant*) had been preferred by M. Roux, (*Journ. Hebd.*, t. II., p. 357.) Flaps cut in the form of folding doors of windows — (*en battants de fenêtre*;) which were disapproved of on account of the *queue* (see Vol. I.—incisions) by M. Syme, and employed in 1813 and 1814 by M. Champion (*Thèse de 1815*, No. 11, p. 94, Obs. 24) in two cases of extirpation of the fifth metatarsal bone, can neither wound nor destroy any of the muscles here. A single quadrilateral

flap with its base above or even below, would be better nourished than the flap with its base posteriorly, of MM. Blandin (Paris, *Thèse de Paris*, 1829, No. 162, p. 17) and Jobert. In consequence of the alteration and adhesions of the soft parts which covered the body of the metacarpal bone, M. Barbottin made an ovalar incision from which he extirpated the flap. But the *window-door* flaps, (see a few lines above,) properly extended, and which offer precisely the most liberty at the very spot where we have to lay bare the articulations, have the advantage also of ensuring the nutrition of the skin better than the quadrilateral flap. Both kinds, however, may be useful.

Though some practitioners commence with the disarticulation, M. Roux on the contrary has preferred sawing at first the first metacarpal bone in its body by means of Aitken's saw. It is evident that we manipulate better around this bone when it is movable, [See notes above in reference to this principle of M. Chassaignac's exsections—also the abrégé of his memoir below. T.] “I also, says M. Champion, should prefer this mode of procedure for any one who is in the habit of using the chain-saw,” but in the contrary case, and when we reflect with what readiness this instrument catches, I think we should do better to use the small couteau saw, or one of the known osteotomes, and which could be worked without any preliminary practice. M. Kramer (Jæger, *Œuvr. cit.*, p. 11, No. 1) exsected the anterior extremity of the first metatarsal bone in 1826, for a compound dislocation. M. Josse (*Mél. de Chir.*, p. 352, 1835) speaks of a case in which the luxated head of the first metatarsal bone was exsected, and the movements of the great toe after the cure were preserved. This excision also must have been successfully performed in the following case related by M. Cruveilhier, (*Arch. Gén. de Méd.*, t. IV., p. 163.) An internal sequestrum was found in a dead body in the anterior extremity of the first metatarsal bone, which bone was of double its natural size. Almost the whole of the bone was necrosed and mobile, in a shell of thin walls, shut up by the most superficial layer of the compact tissue. The cartilage was sound.

M. Blandin, (*Nouv. Bibl. Méd.*, Janvier, 1828,) who in one case exsected the anterior half of this bone for a spina ventosa, in another case removed the three anterior fourths of it, (*Journ. Hebd. Méd.*, 18 Octobre, 1828, p. 75,) being an inch and a half in length, while M. Jobert, (see *Lancette*, t. V., No. 119, 28 Février, 1832, for both these cases,) has removed the anterior half for caries. M. Roux informs me that he has performed this operation three times with success. In a case of caries of the first metatarsal bone, Heister (*Instit. Chir.*, liv. V., ch. 9) exsected only the middle and posterior portion which were the only portions found affected. M. Graefe (Jæger, *Œuvr. cit.*, p. 20, No. 1) also in the year 1828, removed a portion of the first metatarsal. M. Fricke (Guernet, *Arch. Gén. de Méd.*, 1837) who states that he succeeded in exsecting the whole metatarso-phalangeal articulation of the great toe, appears to have been

no less fortunate in removing the phalangeal articulation of the same member in another case! M. Champion (*Thèse*, p. 93, 1815) has twice exsected the posterior extremity of the first phalanx of the great toe, in a state of caries, and in both instances the patients recovered perfectly.

§ II.—*Bones of the Tarsus.*

Horstius speaks of a case in which a portion of the bones of the foot, of three fingers' breadth in dimensions, was extracted, and in which the patient nevertheless was enabled to walk without limping. De la Motte (*Traité de Chir.*, obs. 264) also extracted with success what remained of the third cuneiform bone, after it had been crushed by a ball. A Captain Franckenberg received a gun-shot wound in the foot; Bilguer (*De l'Inutilité de l'Amput. des Membres*, p. 124, § 136) took out nearly all the bones of his foot, (lui désossa le pied presque en entier,) and then brought into coaptation the two portions that remained. The operation was so successful that this officer was enabled to walk and to resume his duties by means of a heel of double the usual thickness! Saviard, (*Observ. Chirurg.*, etc.) who removed a cuneiform bone and some fragments in a case of necrosis, was imitated by De la Motte, who with like success extracted the second and third cuneiform bones, and the fifth metatarsal, which were also necrosed.

M. A. Séverin, (*Méd. Efficace*, § 2129, p. 579,) who in the year 1646, extracted carious portions of the astragalus, os calcis, and scaphoid bone, with a knife heated to red heat, says he left in this manner a hollow sinus around the malleolus, which resembled the mouth of a wolf, but that nevertheless his patient got well. A scrofulous caries, which a student of law had been affected with for a long time, resisted every kind of remedy, both internal and external, and even the repeated application of fire. A. Didier (*Disc. Prélim. sur la Chir. Prat.*, p. 28,) removed the whole of the caries by means of the gouge acted upon by repeated slight strokes of the hammer, and the wound cicatrized in a month.

Pezoldi (*Observations Médico-Chirurgicales*, observat. 70, p. 175, Vratislaviæ, 1715, in 12mo) speaks of an operation performed by F. C. D'Armbruste, a celebrated surgeon of Breslaw. A little girl, aged twelve, had had for five years an ulcer situated upon the left foot. *Twenty-seven* bones of greater or less size were extirpated from the middle and outer portion of the tarsus. There remained only those which were connected with the great toe, (au ponce du pied,) and the operation was performed with the customary skill of this surgeon. A poor child, aged nine years, who had been affected a long time with swellings of the joints, and whose sufferings were such as to make her wish for death to put an end to them, was operated upon, and cured in the same manner, by the same practitioner. In another case, in spite of the existence of an ulcer, with caries of the great toe of the right foot, and much other disease (bien d'autres désordres) in the left foot,

Armbruste, (*Ibid.*, obs. 89, p. 187,) who is known also under the name of Frère Cosme, did not despair of success. Dilating the narrow fistulas (ulcères) of the left foot by means of gentian, sponge, or incisions, he attacked the carious bones with the rasp or red hot iron, or removed the whole of them completely. The operation being terminated, he filled the cavity with plumiassaux, saturated with a particular remedy. The patient was put upon the use of anti-scorbutics, and got well in a few weeks.

De Housse, (*L'Esprit des Journaux*, Février, 1775, t. II., p. 351, in 12mo,) a surgeon of Liège, relates a no less curious fact. M. * * *, aged thirty-six years, sprained his foot when fourteen years of age; having been improperly treated, the injured part suppurated repeatedly. Dilating the ulcerous openings into one wound, by cutting through the bridges which united them, and then laying bare a portion of the bones, De Housse was enabled to take away in succession the three cuneiform bones. In order to remove the cuboid bone, he enlarged the wound near the tendo Achillis, and divided the peroneus longus muscle. Two days after he removed the scaphoid bone. All these bones could be identified, and were black and cragged in their appearance, as if rotten, (vermoulus.) The void left by their extraction, and by that of some portions of the neighboring bones was so considerable, that De Housse made a counter opening on the inner side of the foot, to do which nothing more was necessary than to puncture through the skin. In a very short time this void was filled with sound flesh, and the cure was complete at the end of two months. The cicatrix was firm and deep. The patient was enabled to walk without anything to assist him, and without being fatigued, the distance of ten leagues! Moreau, the father, (*Essai sur l'Emploi de la Résection des Os*, p. 109,) in 1788, extirpated the cuboid, the third cuneiform, the posterior extremity of the fourth metatarsal, the inner side of the same extremity of the fifth, and the articular surface by which the os calcis is united to the cuboid.

Dunn, (*S. Cooper, Dict. de Chir.*, t. I., p. 96, col. 2,) in a case in which he extirpated several bones from the tarsus, and also the upper portion of the astragalus, had a hemorrhage come on so abundant that he found it difficult to arrest it. There is a case of Durand, (*La Théorie du Chir.*, t. II.,) of a patient, aged sixteen years, who in the year 1745, while sliding, injured the foot in such manner as to lead to the supposition that the fibula was dislocated. Abscesses formed, and on opening, left fistulas; the foot was so swollen and round as to resemble a ball; while the leg and thigh became atrophied. Durand, after ascertaining the existence of caries of the os calcis, astragalus and cuboid bone, made two incisions, dilated the fistulous openings into one wound, laid bare the diseased bones and instantly removed to the number of about ten fragments, which were entirely separated. The swelling subsided; twenty-one canterizations with the red hot iron were now had recourse to, and the whole number of pieces of bone that were taken away, amounted finally to 37. The patient enlisted, (s'est engagé,) and served 13

years, dating from the year 1751, his foot and leg not differing apparently from the other limb. M. Liston, in 1821, (Jæger, *Op. cit.*, p. 26, No. 3,) removed the astragalus, scaphoid and two cuneiform bones, together with the internal malleolus at the same time, and M. Arbey (*Coup-d'Œil sur l'Amp. des Membres*, p. 11, 1805; *Thèse de Strasbourg*) says that in 1805, he was an eye-witness to the extirpation of the cuboid, and third cuneiform bone. The extirpation of the cuboid, and of a part of the neighboring bones was made by M. Syme, (*Treatise on the Excision of Diseased Joints*, ch IX., p. 143.) M. Ma'vani, (*Gaz. Méd.*, p. 314, No. 24, 1838,) after extirpating the two last cuneiform bones, had recourse to repeated use of the hot iron (ustion) to the scaphoid, and cured his patient, a child, aged twelve years. M. Champion, (communicated by the author,) after having extirpated the cuboid, scaphoid, and three cuneiform bones, and the tarsal extremity of the third, and also of the fourth and fifth bones of the metatarsus, found the caries re-appearing in the other bones before cicatrization took place. A similar case, which has not been published, occurred in the practice of Moreau, the son. The case in which M. Liston, in 1832, removed the os naviculare, two cuneiform bones, and the upper surface of the astragalus, did not succeed. Jæger (Jæger, p. 26) also has extirpated the astragalus and scaphoid bone.

The *cuboid, scaphoid and great cuneiform bones*, should they be altered to such extent that they could not be preserved, might be separately removed, as for example in a case of dislocation, complicated with caries and rottenness, (vermoulure,) or with necrosis. M. Moreau in this manner was enabled to save the greater part of the foot to one of his patients, by confining himself to the removal of the cuboid bone, the third cuneiform, a part of the os calcis, and the posterior half of the fifth metatarsal bone. It was thus, also, that in the year 1636, Heurnius (Patric, *Lancette Française*, t. IV., p. 88) extracted with perfect success the *cuboid and third cuneiform bones*, and it is in this manner we ought to proceed, in reality, wherever the disease is found to be perfectly circumscribed, and we are certain of removing it totally without being obliged to sacrifice the other portions of the foot. But here also there are no precepts that can be laid down. The enlightened surgeon will always know how to regulate his conduct by the circumstances in which he is placed, and to select the process which is best adapted to each particular case, while he will not forget also that these partial amputations are not unattended with danger, and that they are often followed by consequences more formidable than actual amputation of the foot or leg.

Now that we possess rowel saws, flat or mushroom-shaped, we can excise these bones with less danger than if it were necessary to disarticulate them. By means of a T incision, whose horizontal branch was placed on the outer border of the foot, I was enabled with the mushroom-shaped rowel saw to lay bare and remove almost the whole of the cuboid bone and the posterior extremity of the fifth metatarsal bone, in the case of a young man (Pétre-

quin, *Gaz. Méd.*, 1837, p. 36) who recovered with scarce any deformity remaining.

Os Calcis.—I shall be obliged for other matters appertaining to this subject, to refer to the chapter on *Articular Exsections*. The subject of amputation of the projecting portion of the os calcis, which I have performed six or seven times successfully, will have to be resumed upon that occasion.

§ II.—*Astragalus*.

The extraction of a portion of the astragalus, dislocated and with or without fracture, and either necrosed or retaining its vitality, has been performed by Duverney, (*Traité des Malad. des Os*, p. 458, t. II., Obs. 8;) while this bone in another patient exfoliated almost entire, yet he could walk with this leg as with the other, though it was ankylosed. In the case of Aubray (*Anc. Jour. de Méd.*, t. XXXVI., p. 361, 1771) the astragalus was extracted on the first day of the fracture and luxation; and in that of Rumsey (*Dislocations and Fractures*, etc., by Astley Cooper, p. 230) the loss of the greater portion of its body did not prevent the almost entire restoration of the movements of the foot. Charley (*Pract. Obs. in Surgery*, by Hey of Leeds, p. 386) succeeded in a case in which the extraction of the body of this bone which had been luxated and fractured, was not made till the twelfth day after the accident. In a case of unreduced luxation, Hey (*Ibid.*) proposed exsection; the patient refused; gradual exfoliation of the protruded portion of the astragalus, in small fragments, then followed. In a patient of Battley (A. Cooper, *Œuv. Chir.*, etc., p. 202) a portion of the astragalus which had been fractured in its position (*sur place*) was extracted through the accidental wound. Lynn (*Ibid.*) saw a case in which the astragalus exfoliated in two portions with an interval of six weeks. Trye, (Hey, *Œuvr. cit.*, p. 383,) in the case of Madame Palmers in 1789, in which the astragalus was luxated, complicated with laceration, and irreducible, exsected it with very little difficulty.

The successful cases of extraction or removal of the dislocated astragalus are moreover numerous and of various kinds. Fabricius of Hilden, (*Opera*, l. 140, Obs. 67, cent. 2, t. I.,) published a case of this kind in 1582. This operation has been performed since by Vonder Broille (*Geschichte und Versuche einer chirurgischen Privatgesellschaft*, etc.) in 1773, also by Marrigue (*Diss. sur les Fract.*, par Michault de Versailles, p. 55, 1782,) Ferrand, Mauduyt, (*Méd. Eclairée*, par Fourcroy, t. II., p. 63, 1791,) Laumonier, (*Ibid.*, p. 60,) and Desault, (twice,) and who also saw other cases; by Boyer, Hey, (*Practical Observ. in Surgery*, p. 383,) Collin, (*Journ. de Méd. cont.*, t. XVII., p. 438,) Percy, (*Operatio Resectionis Conspectu*, etc., Jæger, p. 25, No. 12,) Despault (*Journ. de Méd. cont.*, Dec., 1812, p. 388; et *Bull. de la Fac. de Méd.*, Paris, t. III., p. 238,) Daniel, (*Journ. Gén. de Méd.*, t. XLIV., p. 293,) and Evans (*Practical Observations*, &c., 1815; and S. Cooper, (*Dict. de Chir.*, t. II., p. 127–128;) by Dupuytren, the third of April, 1818, on a woman,

the nature of whose injury was unknown during the first days; by M. Roux the 20th of September, 1817, and again by him a second time (communicated by the author;) also by M. Larrey, (Jæger, *Ouvr. cité*, p. 25, No. 16,) Dufaure, (*Journ. de Méd. continué*, t. XXII., p. 348,) West, (*A Treatise on Dislocation and Fractures of the Joints*, p. 263,) and A. Cooper, (A. Cooper, *Ibid.*, p. 268.)

Many other surgeons also have performed the evulsion of the *astragalus*, and by this means preserved to the patient the uses of his foot and leg. Additional examples are related by Dupuytren, (*Journ. de Méd.*, 1812; *Bull. de la Fac.*, t. III., p. 238; this case, says M. Velpeau, as well as that of Despault, belong to De Cugnières,) by Follot, (*Arch. Gén. de Méd.*, t. XVIII., p. 462; t. XX., p. 293,) Dassit, (*Bulletin de Férussac*, t. VIII., p. 325,) and De Cugnières. In a case operated upon by M. A. H. Stevens, (*Medical and Physical Journal*, Vol. V.,) in 1826, the tibio-tarsal articulation continued moveable, and the limb scarcely deformed. But the cases are rare, except after luxations with laceration of the soft parts, that such an operation is either indicated or practicable.

As the state of the parts after the wound, is scarcely ever the same in two different persons, it is impossible to lay down any fixed rules to be followed for the process. We dilate the wound sometimes in one direction, sometimes in another, according as the exigencies of the case require, taking care, however, to divide the tendons no more than is absolutely required, and to operate before the constitutional reaction has had time to set in, and as soon as possible after the accident.

This operation has been performed also by MM. Barbieux brothers, (*Journ. Complém. du Dict. des Sc. Méd.*, t. IX., p. 285, 1821,) Weber, (Jæger, p. 26, No. 23,) Lochmann, (*Bull. de Férussac*, t. II., p. 333,) Champion, (unpublished—communicated by the author,) and Cloquet, (Jæger, *Ouv. cit.*, p. 26, No. 26.) In the cases mentioned by G. Norman (A. Cooper, *Ouv. cit.*, p. 252) and M. Green, (*Illustrations of some of the Injuries to which the Lower limb is exposed*, p. 30, 1802,) the extraction of the *astragalus*, performed in consequence of luxation, appears to have been followed by retraction of the tendo Achillis or a pes equinus.

The extraction or excision of the *astragalus* in a state of caries, but still in its natural position (dans ses rapports) in respect to the leg and foot, has been performed, 1st, by Moreau, the father, (*Essai sur l'Emploi de la Résection*, par Moreau, fils, p. 89,) who removed the superior articular surface, and a great portion of the body, by means of the gouge; 2d, by Moreau, the son, (*Ibid.*, p. 93,) who removed it entire with the gouge, the presence of a sound fibula preventing him from luxating the foot; 3d, by M. Champion, (unpublished case, communicated by the author,) who extirpated the entire tibial portion with the saw; 4th, by the same surgeon after excision of the fibula and tibia, (*Ibid.*)

In a patient of Desault, who died two months after the operation, of hospital fever, the tibia was found in a state of almost complete consolidation with the os calcis. In a case of Hey, (*Pract. Obser-*

vations in Surgery, p. 383,) the patient at first did very well; but being asthmatic, he died between the second and third week; the patient of Norwood, (Jæg., *Œuvr. cit.*, p. 28, No. 18,) also died, as did one of those of July, 1830, (*Journ. Univers. Hebd.*, et *Journ. Complém.*, t. XXXVII., p. 33, 1830,) that of M. Dassit, (*Journ. Gén. de Méd.*, t. XCIII., p. 183, 1825,) that of M. J. Cloquet, (*Journ. Hebdomad.*, t. I., p. VII., 1831,) and one of my own.

The success of the operation was doubtful in the case of M. Hesselbach, the son, (Jæger, p. 26, No. 27,) and amputation had to be had recourse to in the patient of Duverney, (*Maladies des Os*, t. II., p. 276,) who nevertheless died. The patient of Bromfield, (*Practical Obs. in Surg.*, by Hey of Leeds, p. 382,) also died, and that of Gooch, (Tome II., p. 369,) perished on the twenty-seventh day in consequence of imprudence; while in the cases of Castel, (Borne-mann, *Sensibilité des Tendons*, Th. de Haller, t. III., p. 307,) A Cooper, Boyer, (*Traité des Mal. Chir.*, t. IV.,) and Dupuytren, (*Trad. du Dict. de M. S. Cooper*, p. 64,) the cure on the contrary took place without any delay.

ARTICLE II.—THE TIBIO-TARSAL ARTICULATION.

Gooch (*Wounds and other Surg. Subj.*, 1667,) a long time ago performed with success the operation of exsection of the lower extremity of the tibia. This operation was repeated by Cooper, (*Trad. de Park*, p. 7,) Hey, (*Pract. Obs.*, &c., 1814,) Deschamps, (*Bull. de la Fac. de Méd.*, 7e année, p. 141,) White, (*Cases in Surgery*, 1770,) Park, (Jeffray, *Op. cit.*, p. 71,) Delpech, and Moreau, (*Op. cit.*, 1803, 1816,) the father and son. Josse, (*Bull. de la Fac. de Méd.*, t. VI., p. 414,) and M. Roux, (*Journ. Hebd. Univ.*, t. II., p. 357,) have also successfully exsected the tarsal extremity of one or both bones of the leg. Though they removed two inches of the right tibia, in one case, and more than an inch from the left tibia and fibula in another, the patient of Josse at the end of three months walked with the aid of a cane, which she has since been enabled to dispense with. Repeating this operation on a woman, in whom he exsected only the tibia on the fifth day of the accident, on a man aged seventy-three years, and on another man aged sixty-five, Josse, (*Mélang. de Chir.*, p. 310, 315, 321, 332,) was alike successful in all of them. M. Veiel, (*Gaz. Méd.*, 1834, p. 747,) was equally fortunate though he did not operate until the eighth day. MM. Walther, Textor, Jæger and Heine, (*Ibid.*, p. 644,) also speak very highly of this exsection, which I have performed twice on the tibia only, which M. Patry, (*Thèse No. 289*, Paris, 1837,) has seen twice performed by M. Thierry, and of which he relates sixteen cures out of seventeen cases, taken chiefly from M. A. Cooper.

The numerous cases of dislocations of the foot, complicated with fracture and protrusion of the bones through the skin, in which it has been found necessary to extract the astragalus, exsect the tarsal extremity of the tibia, or fibula, at the same time or separately, either to reduce the displacement, or to prevent or arrest the acci-

dents, which menaced the patients; and the advantages which the patients have thereby obtained, have now consecrated the utility, (*précepte*) of this kind of operation. Emboldened by his experience, Josse, (*Mélang. de Chir. Prat.*, p. 310, obs. 26,) has even extended the application of this exsection to luxation of the tibia, with fracture of the fibula and displacement, *but without any wound*, in order to combat symptoms of a very serious character.

It is true, that in almost all these cases, this excision has not been decided upon, except in those of compound dislocations, or comminuted fractures; but many persons have employed it also for organic lesions, that is to say, where the parts had not changed their natural relations. In 1792, Moreau, the father, performed the peroneo-tibial exsection, in a case where the articulation was entire, and where there was no displacement of parts. The leg of the patient was seen and admired by A. Dubois. Moreau, the son, operated upon a man of the name of Meunier, in 1796. The most serious objection to this last operation was, the omission to exsect the fibula, which left the patient a cripple, (*infirmé*.) In 1810, Mulder, exsected five inches from the fibula affected with caries. In 1832, Jæger, (*Op. cit.*, p. 9, No. 4,) could not yet say what had been the result of this operation. On the 6th of March, 1813, M. Champion operated in the same manner on Therese Péru, who has repeatedly since, walked three leagues on foot to show herself to MM. Roux, Flamart, Fodéré, &c. M. Liston, (*d'après Jæger*, p. 9, No. 5,) also as I have said above, removed in the same manner, in 1821, the internal malleolus, the astragalus, the scaphoid and two of the cuneiform bones. The details of these cases would doubtless elucidate the history of the preservation of the fibula, when the tibia has been exsected with the astragalus. On the 3d of April 1830, M. Champion also operated for caries upon Etienne Chauvel, who at present can use his foot very advantageously. In 1832, M. Roux was less fortunate, and lost his patient.

I. *Process of Moreau*.—Moreau recommends that we should make two incisions on each side of the leg, one which should reach from the apex of the malleolus to three or four inches above it; the other which is to commence at the same point, and to be brought transversely in front to the insertion of the peroneus tertius muscle, for the outer side, or that of the corresponding tibialis anticus, for the inner side. The longitudinal incisions should go down to the bone and the others comprise only the skin. We commence with the dissection of the outer flap in order to disengage the fibula from the tendons which surround it, and then to exsect it with the chisel or the crested saw above the part which is diseased, disarticulating it from above downwards, while dividing the fibrous bundles which unite it to the tibia, astragalus and os calcis. The same manipulation is employed to isolate the tibia from the soft parts, in order to exsect and then disarticulate it. If the astragalus itself should be diseased, it would be requisite to remove it also, in whole or in part, as was done by Moreau, the son. After the operation, the foot should be brought gently into approximation with the lower extre-

mity of the leg, and maintained in this position by strips of adhesive plaster, and a suitable starch bandage (bandage inamovible.)

§ II.—*Process of M. Roux.*

We perceive that Moreau follows in this operation the same process he adopts for the carpal extremity of the fore-arm. In place of the chisel or mallet, it would be more advantageous at the tibio-tarsal articulation than anywhere else, to use the trephine or the link-chain saw, (*scie à chainons.*) In spite of the narrowness of the inter-osseal space, M. Roux was enabled, on one occasion, to insert a compress through it, which thus enabled him, after introducing Jeffray's saw between the bones and the soft parts, to exsect without danger, first the fibula and afterwards the tibia. The osteotome of Heine, or the rowel saw, moreover, would, at the present time, render the section of the bones by these processes quite an easy matter.

§ III.—*The Author.*

I should prefer, however, if the tibia or fibula alone were concerned, to lay bare the diseased malleolus, by means of a large semilunar flap, whose convex border should face upwards and forwards. By reversing this flap backwards and downwards, we should have every facility for exsecting and removing the diseased bone. Two such flaps would equally enable us to exsect both bones.

§ IV.—*Appreciation.*

This exsection, which is always a difficult operation, will sometimes be followed by severe accidents. A case operated upon by M. Roux terminated fatally. After the most perfect cure, the limb will have necessarily lost a portion of its length, and the patient cannot walk without the aid of a shoe more or less elevated. It presents, then, but few advantages over amputation of the leg. The exsection of the tibia alone, especially, does not seem to answer the purpose the surgeon has in view. The foot thus losing its principal point d'appui, will be incapable of sustaining the weight of the body, and everything leads to the belief that it will be turned inwards, as Moreau remarked in one of his patients. It would appear, therefore, that the fibula, although it be sound, ought in these cases to be excised at the same time with the tibia.

§ V.

When the *tarsal extremity of the fibula* is to be removed, would its loss necessitate also the exsection of the tibia? "To judge of this question," says M. Champion, "by what happens in cases of fracture of the lower extremity of the fibula, when we cannot re-

duce it as we wish, we may answer, as I have done in 1815, in the affirmative; but at the present time, and in other cases, I should willingly leave this question open."

Gouey, (*La Véritable Chirurgie*, Rouen, 1716, p. 130,) in 1716, published the case of a man, in whom an empiric (bailleur) extirpated, without any apparent reason, the lower part of the fibula which had been fractured at three fingers' [breadth] above the malleolus, and had protruded through the flesh. Improper treatment resulted in necrosis, and made it necessary to resort to extraction of the astragalus. Nevertheless, and in spite of other accidents still, the patient got well, and *could walk without a cane, and as though he had not lost the astragalus*. Gouey attributes this result to an osseous juice, which, having oozed out and coagulated in the void left, had formed an irregular callus, which could be felt through the integuments at the spot and place which the fibula had occupied.

Faure (*Prix de l'Acad. de Chir.*, in 12mo, t. VIII., p. 50, Obs. 2; et in 8vo, t. III., p. 352, 1819,) quotes from Read, a case of wound from a fire-arm, in which it became necessary to extract the lower third of the fibula, several portions of the lower extremity of the tibia, and some fragments of the astragalus. The fibular portion was not reproduced; the osseous juice had formed a species of incrustation which had become united to the tibia, and the whole formed but one bone. It would appear that an ankylosis had taken place between the tibia and the astragalus, and that it was this consolidation (*soudure*) which must have prevented the deviation of the foot. It is much to be regretted that the cases which M. Cooper (*Œuv.*, &c.; *trad. Franç.*, p. 42-56) obtained from MM. Ransome, Maddocks, Ormond and another person whom he does not name, and in which the external malleolus (without anything being said of deviation) was removed, are too deficient in details to afford any light upon this point of practice. I would express the same regret of the case of exsection performed by Mulder, (*Wachter, Œuvr. cit.*, p. 154,) in which he removed five inches of the lower and articular extremity of the fibula affected with caries, but of the result of which we are left in ignorance.

The organs to be avoided are: 1, in front, the tendons of the tibialis anticus muscle, those of the extensors of the toes, and of the peroneus tertius; 2, outwardly, the peroneus longus and peroneus brevis muscles; 3, on the inner side, the tibialis posticus muscle and the flexors; 4, behind the semi-muscular portion of the same organs; 5, finally, the anterior tibial artery in the first direction, and the posterior tibial with the nerve, behind the internal malleolus.

§ VI.

Exsection of the tibia, in consequence of fracture of its tarsal extremity, was successfully performed by Hey, (*Pract. Obs. in Surg.*, p. 363,) in 1799, and that of the malleolus internus, with re-

removal of the astragalus, has been performed by Weber, (Jäger, p. 10, No. 25, et p. 26. No. 23.) Examples of exsection of the tibia in cases of tibio-tarsal luxations with laceration of the integuments, have been related by Serrin, (Observation addressed to the Academy of Surgery, recompensed with a medal of gold, 1776,) Marri-gues, (*Dissert. Physiol. et Chirurg. sur la Formation du Cal.*, &c., p. 26, 1783,) by Taylor, (*Pract. Obs. in Surg.*, by Hey, p. 381, 1805,) who performed this operation four times, by Kerr, (*A Treatise on Dislocations and Fractures of the Joints*, p. 67, Sir A. Cooper, p. 229, 1831,) who performed it several times, (plusieurs fois,) Lynn, (*Ib.*, p. 239,) Flour, (*Ann. de Méd. Clin. de Montpellier*, 1809,) who performed it three times; by Averill, (In A. Cooper, p. 228; *trad.*, p. 52,) Cooper of Brentford, (*Ib.*, p. 237,) by A. Cooper, (*Ib.*, p. 235; *trad.*, p. 54,) Vernhes, (*Ann. de Méd. Clin. de Montpellier*, t. IX., p. 186, 1820,) Sandfort, (A. Cooper, p. 226; *trad.*, p. 51,) Graefe, (In Jäger, *Oper. res Consp.*, etc., p. 9; A Cooper, *tr. Fr.*, p. 55,) and Tyrrel, (In Jäger, p. 10.)

Examples, on the other hand, of exsection of the tarsal extremity of one or both bones of the leg, are related by Kirkland, (*Ibid.*) Moreau, the father, (*Essai sur l'Emploi de la Résect. des Os*, p. 94,) who excised the lower extremity of the tibia, sawed off the two fragments of the fracture of the fibula, and left the external malleolus; by Hicks, (A. Cooper, *cité*, p. 233; *trad. Fr.*, p. 54,) Fletcher, (*Ibid.*, p. 238; *trad. Fr.*, p. 54,) and A. Cooper, (*Ibid.*, p. 225; *trad. Fr.*, p. 51.) The excision of the tarsal extremity of the bones of the leg, with partial exsection or removal of the astragalus in a state of caries, has been performed once by Moreau, the father, (*Essai sur l'Emploi*, &c., p. 87,) and twice by M. Champion, (Unpublished Observation, communicated by the author;) M. Roux, in going to Plombières sixteen years since, had an opportunity of seeing the first of these two cases. This exsection has been once performed also by Moreau, the son, who confined himself to the exsection of the tibia alone, and the astragalus. Ransome removed the external malleolus which had been separated by fracture, and Moreau, the son, (*Essai cité*, p. 98,) removed in this manner the anterior half in a state of caries.

ARTICLE III.—EXSECTION OF THE KNEE-JOINT.

§ I.

Caries, necrosis, abscesses, tubercles, cancers, and all those kinds of lesions comprised under the name of white swellings, (*tumeurs blanches*,) often become so serious as to be beyond any other remedy than the removal of the diseased parts. As amputation of the thigh removes the whole of the limb, and obliges us to sacrifice a great extent of sound parts, the question has been asked if it would not be possible to restrict ourselves to the removal of the tissues and the portions of bone actually diseased: from whence has originated

the idea of exsection of the knee-joint. It is an operation which consists in the extirpation of the articular extremities of the femur or of the tibia, or of all those parts at the same time.

The excision of the bones which form the femoro-tibial articulation, has now been performed upon living man a great number of times; once by Filken, (Jeffray, *Op. cit.*, p. 52) in 1762; once by Dr. Park, and with such success as to enable the patient to walk without a cane, (*Nouv. Méth. de traiter les Maladies qui Attaquent le Genou*, trad. Franç., 1784,) the third time by Moreau, (*Obs. sur la Résect. des Art.*, 1803,) and once by Moreau, the son, (*Essai sur la Résect. des Os*, 1816,) whose patient for a long time was obliged to make use of crutches. Mulder (Wachter, *De Articulis Extirpandis*, etc., 1810) related a case of this kind in 1809; M. Roux (Private Correspondence, 1831) has published another case; his patient died on the nineteenth day. M. Crampton (Syme, *Excision of Joints*, 1831) has performed this operation twice: on a girl aged twenty-three years on the 7th of May, 1823, and on his second patient in 1834. The first survived, and actually is enabled to walk without crutches, notwithstanding the deformity of the limb; the other died from the consequences of the operation. M. Syme (*Op. cit.*, p. 29) also has performed this operation twice: one of his patients died on the eighth day, the other, a child aged eight years, recovered and walks very well. M. Fricke informs me that he has performed it four times. MM. Jæger and Textor also have each performed it once, (Coulon, *Op. cit.*, p. 45.)

Exsection of the knee in consequence of compound fractures, also requires to be mentioned. In the patient operated upon by Read (*Prix de l'Acad. Chir.*, in 12mo, t. VIII., p. 47; in 8vo, t. III., p. 352) the external condyle of the femur and a portion of the patella had been crushed to pieces by a ball. After having dilated the wound in order to extract the detached fragments, crowns of the trephine were applied to a part of the bone in order to remove a portion of it of the width of two fingers' breadth. No serious accidents supervened. An abscess which formed at the lateral and posterior part of the thigh, enabled the surgeon to extract the ball four months after the accident; a large sequestrum of three fingers' breadth, was removed at a later period by means of an incision, and the cure was not completed until at the end of eleven months. The patient was enabled to walk without any assistance, but with a thigh shorter than the other by four inches. Heaven grant (à Dieu ne plaise) that I may not give this operation for a pattern, although it is very remarkable! Read was like Gelée, more fortunate than skilful. In another case M. Travers (cité par Jæger, p. 8, No. 13) confined himself to the exsection of the external condyle of the femur. Three inches of the tibia and of the head of the fibula, a small portion of the patella and of the condyles of the femur, were, says Percy, (*Manuel du Chir. d'Armée*, par Percy, p. 262,) carried away by a small bullet. Serious accidents and danger of the loss of life succeeded to this wound; the commotion,

(orange,) however, subsided, and the exfoliation of the bone was promptly followed by a cicatrix with ankylosis.

A fracture existed at two fingers' breadth from the knee, and the tibia protruded outside to the extent of three fingers' breadth. The reduction was difficult, notwithstanding the usual dilatations; the cure was protracted to eight months in consequence of the exfoliation of the tibia, all the upper part of which was removed; the cicatrix which remained being so deep that the patient in putting on his boot (*en se chaussant*) was obliged to fill it up with a pelote of linen of the size of a tennis ball, (*balle de tripot*.) Saviard (*Observ. de Chir.*, Obs. 28) who relates this case, does not say what effect this accident had on the walking of the patient.

A young man whose case is given by Janson (*Compte-rendu de la Prat. Chir. de l'Hôtel Dieu de Lyon*, p. 77, 1822) fell with his knee upon the cutting edge of a scythe. The articulation was laid open to a great extent. The lower extremity of the femur, which was luxated upon the leg, was split (*fendue*) from below upwards to the extent of two inches. The laceration (*délabrement*) was so extensive, that no other resource was left but amputation of the thigh; the patient objected to this, but consented to exsection. *The operation was very long and very laborious.* After having disarticulated the femur, Janson passed an amputation knife into the popliteal space in order to detach the soft parts and artery from the bone; the bone was then sawed off and the whole united as accurately as possible. Some hope of recovery was entertained until the fifteenth day; but the impossibility of maintaining the extremity of the femur in a fixed position, from the rotating muscles of the thigh constantly turning it outwards, together with the abundance of the suppuration and some aberrations in the regimen, caused death on the thirtieth day.

In a case of caries of the inner condyle of the tibia, M. Champion (*Thèse de 1815*, p. 7) having cut out a square shaped flap, was enabled by means of the gouge and chisel, to remove the whole of the diseased portion of the bone to the depth of near an inch, together with the ball which had become embedded in it. Desport (*Traité des Plaies d'Armes-à-Feu*, p. 225) also thinks that in cases of fracture of the leg we ought not to be in too great haste to amputate, if no other part is fractured but the upper portion of the fibula, unless the neighboring bones or some other important parts should be implicated. Scultetus (*Arsenal de Chir.*, 2e part., p. 104, obs. 81, 1712) having extracted a sequestrum of considerable size from the tibia, removed by means of the trephine *the head of the fibula which was in a carious state*, and cured his patient. Bécларd was equally fortunate in exsecting the extremity with the upper third of the fibula, for a spina ventosa or medullary fungus.

§ II.

It is certainly not because of the difficulties which exsection

of the knee joint presents that it ought to be proscribed, but because it is infinitely more painful, tedious and dangerous, either immediately or subsequently, (secondairement) than amputation in the continuity of the thigh; and especially because in the most fortunate cases the limb preserved is in reality not as useful to the patient as an artificial leg. As a necessary consequence there must be a shortening of from three to eight inches; the articulation cannot be restored; the limb if it preserves the faculty of motion performs it only in a very irregular manner, and most usually is strongly deviated outwards. Of the cases that have fallen under my observation, ten at least have perished, some like the case of M. Roux at a very short interval after the operation, others after having suffered for a long time; all those who have been cured have obtained this result only by means of extraordinary care, and not without having incurred the greatest danger of losing their lives; it is also certain, notwithstanding what M. Syme may say, that none of them can do with their misshapen limb what they would be enabled to execute with a wooden one properly made. The case of Moreau, the father, (*Op. cit.*, p. 57,) died three months after the operation of an epidemic dysentery; the limb had undergone much shortening. A second case operated upon by Park in 1789, died from exhaustion at the expiration of four months, (Syme, *Op. cit.*, p. 129.) The first case of M. Crampton died three years and a half after the operation, without ever having been perfectly cured; the other walks with a sole which has to be four inches thick, (*Dublin Hospital Reports*, Vol. IV.) That of Mulder terminated fatally. M. Fricke, who cured only one out of four cases, hopes never to repeat the operation. The first case operated upon by M. Textor also died. Another patient whom this surgeon operated upon in 1836 (Communicated by M. Sprengler, November, 1838) was equally unfortunate. In the case of M. Jæger (Rust's *Handb. der Chir.*, Band V., p. 626; et *Op. Rés.*, p. 8, No. 12) the result at first was most flattering, since from the figure that M. Adelman sent me of it, and especially from what this physician who attended to the progress of the case has told me, the patient scarcely limps, and can without any impediment undergo the most fatiguing labors; but as he has not been cured but five months, and as the limb which is shortened three inches is strongly deviated outwards, and that one side of the ankylosis constantly threatens to ulcerate through the skin, the question may still be asked if amputation of the thigh and an artificial limb would not have been preferable. The operation, therefore, is one whose utility may still be questioned at the present day, as it was at the time M. Denoue wrote his Thesis, (Paris, 1812.) The following, however, are the principal processes which have been employed, and which may be adopted, should any motive induce us to attempt the operation.

A. *Process of Park.*—A crucial incision, whose transverse branch, placed above the patella, would comprise the half of the circumference of the limb, constitutes the characteristic feature of the process of Park. After having divided the tendons of the extensor

muscles of the leg, and turned back the four flaps, raised up the patella, made the section of the lateral ligaments, and divided through the articulation from before backwards, Park inserted a large knife along the posterior surface of the femur, in order to detach the soft parts from it, while taking care to avoid the popliteal vessels. Nothing more remains than to saw the bone above the condyles; the extremity of the tibia is afterwards exsected with the same precautions.

B. Process of Moreau.—The articulation of the knee being, in almost every respect, similar to that of the elbow, Moreau thinks that the exsection of the one ought to be performed in the same way as that of the other. Consequently, he begins with two lateral incisions, a little in front of the borders of the ham, which incisions he unites by dividing transversely the skin and ligaments below the patella, in such manner as to penetrate down to the articulation; afterwards he detaches from the posterior surface of the bone, the soft parts which surround it; then dissects and raises up the quadrilateral flap circumscribed by the three first incisions; and afterwards performs the section of the femur, with the same precautions used in the process of Park. If the bones of the leg are also affected at the same time, the outer incision should be prolonged as far as the head of the fibula. Another is made on the crest of the tibia, by which means we have two lower flaps, one on the inner and the other on the outer side, which flaps are to be dissected and turned down, (*abaissé*.) The posterior surface of the tibia is then to be isolated from the vessels and nerves, as well as from the origins of the gastrocnemii; and, finally, all the portions of the diseased bones are to be removed by means of the saw.

C. Process of M. Bégin.—In place of cutting at first a large quadrilateral flap, the new editors of Sabatier commence by a transverse incision below the patella, which extends from one lateral ligament to the other, and penetrates at once into the articulation. This being effected, the femur is disarticulated, or the tibia only, in case only one of the two bones should be diseased, by drawing two lateral incisions from the extremities of the first, prolonging them upwards or downwards, to a greater or less extent, according to the length of the portion of the bone which is affected.

D. Manne had already proposed the following operative process, to excise the head of the bones of the leg: "If the caries affects the upper extremity of the tibia, without invading the condyles of the femur, we may separate it from the patella and saw it off, as well as the upper extremity of the fibula, below the part affected. To effect this, *we make an incision more than semi-circular* (plus que semi-circulaire) *at the anterior part of the integuments, below the ligamentum patellæ*; we raise them up, divide the ligamentum patellæ, the anterior and lateral portions of the capsular ligament, and then the crucial (*croisés*) ligaments; after which we detach the tissues adherent to the posterior part of the tibia and fibula, by directing the cutting edge of the instrument downwards and forwards, to avoid the popliteal artery and nerves. We then divide

the periosteum circularly, and having drawn aside the tissues from the bones by means of a linen bandage or band, complete the exsection. If any portions of the semilunar cartilages are left behind, after dividing the capsule, they are also to be divided. The tibia and fibula are then to be approximated to the condyles of the femur.

E. *The Process of M. Syme* differs from those above, in more respects than one. The operator makes, in front of the articulation, two semilunar incisions, one above and the other below, which are united together on a line with the lateral ligaments, and circumscribe a transverse ellipse, including the patella; he then excises this ellipse and the bone which is comprised within it, divides the ligaments and opens into the articulation, and exsects in succession the diseased extremities of the femur and tibia.

§ III.—*Different Processes.*

In order to exsect the whole knee-joint, Manne (*Ouv. cit.*, p. 52, 1789) cuts an anterior quadrilateral flap which he extirpates. Jeffray, after making his two longitudinal and lateral incisions, finds it unnecessary to encroach to any farther extent upon the integrity of the muscles. When it happens that the patella has remained unaffected in the midst of the alteration of the other bones, as Portal (*Traité de l'Hydropisie*, t. II., p. 295 à 297) has seen in two instances, this process is one of the best that can be adopted. If the soft parts which cover or surround the patella are degenerated or destroyed by ulcers and fistulas, it may be found necessary to operate in the manner of M. Syme. I am not acquainted with the process by which Filkin has exsected the bones of the knee. Park led the way in sawing the femur before disarticulating it, and every one has since imitated him. But it was Manne who proposed to remove the extremities of the femur and tibia in mass, (*en bloc*,) without disarticulating them. The anterior quadrilateral flap being removed, and the tissues detached with the greatest care, "we divide," says he, "the periosteum around the bones, which latter are then to be sawed above and below the articulation." This advice was forgotten and unknown. Mulder (Wachter, *De Articulis Extirpandis*, p. 34, 1810) adopted it without knowing that it had been recommended by others; and Wachter adds that the removal of the bones is thus made with the greatest ease. M. Sédillot has succeeded equally well in applying the process of Manne or M. Syme to the elbow.

I have said above that Manne, in those cases where he had to remove only the carious extremity of the tibia, had, before sawing this bone, dislocated the articulation at the knee, a process indispensable under such circumstances. The head of the fibula, when it is not diseased, should be saved on account of the biceps. Park left it intact; Moreau, the son, (*Essai, &c.*, p. 70,) was obliged to remove it.

§ IV.

The *approximation* of the bones after the exsection must be left to the muscular action. This remark was made by Moreau, the son, with much reason. After the cure, the limb will require for some time the employment of a prop, encasement, splint, &c., in consequence of the tendency of the bones to be deviated into a false direction. It is equally important to prevent their riding upon each other, (*leur chevauchement*.) M. Syme has insisted the most and with the best arguments, (*a le plus et le mieux insisté*), on the necessity of exercising certain movements in the new articulation during the treatment; but the patients he operated upon were very young, and there is nothing to show that remedial means and time would not have cured more than one of these cases without the necessity of exsection.

In whatever way the operation is performed, the bleeding surfaces should be brought into contact and take the place of the bones that have been removed; points of suture, simple adhesive straps, lint and compresses, cushions and splints, in fact all the articles required in a compound fracture of the leg, are necessary to complete the dressing and to keep the limb in a state of the most perfect immobility.

All these processes will enable us to obtain the object we have in view. Whether we adopt the crucial incision of Park, or cut out a large quadrilateral flap like M. Moreau, or like M. Bégin penetrate into the joint with the first incision, or remove the patella or not, like M. Syme, the operation is practicable. It is, therefore, as I have said in the beginning, not in consequence of the manipulating process employed, but from the results which the operation may produce, that it becomes so formidable, and ought, in my opinion, to be generally proscribed. I would except those cases only where the articular surfaces alone are altered in such manner that we would be enabled to remove the whole disease by excising an inch or two of each bone, as for example in the case of M. Jæger.

[EXSECTION OF THE KNEE-JOINT.

As exsections of not only the elbow-joint, as warmly advocated and successfully performed by M. Syme and others, but also of the *knee-joint*, are attracting much attention at present, especially since the complete success which has attended the recent case of entire exsection of the knee by Dr. G. Buck, one of the surgeons of the New York Hospital, [see Vol. I., and also under this article on exsections, a more full account of this operation,] it is, perhaps, judicious to record here one of the latest opinions which has been emitted on this class of operations, by a surgeon who, from his rank, at least, and practical writings on surgery, has a right to be heard; though the remark might, perhaps, be made, that he has

not shown himself here so much *au courant* with the brilliant march of the art, as in some other departments. We refer to M. Bonnet, of Lyon; and the passage we shall quote from his last great work, (*Traité des Maladies des Articulations*, 2 vol. in 8vo., and so late as, Paris, 1845,) and which, we should add, is censured by his reviewer, M. H. Diday, (see *Gaz. Méd. de Paris*, Mai 17, 1845,) may at least serve as a caution to inexperienced persons who would rashly undertake so serious, if not terrific, a mutilation without a decided prospect, both of amelioration of the deformity and perfect consolidation and cure of the wound made. M. Bonnet, speaking particularly of the cuneiform exsection for angular ankylosis, says: "It is one of those operations which may be performed under the influence of those illusions which preoccupy the mind of every one who has invented a new operation; but no one who is not seduced by the charm which clings around all new discoveries, would be willing to expose his patient to the consequences of a compound fracture, and consequently to loss of life, in order to shorten a limb already too short, and to substitute one deformity for another."

CASE OF EXSECTION OF THE KNEE-JOINT BY DR. GURDON BUCK, OF NEW YORK; as revised and corrected by the author for this volume of the American Edition of Velpeau's Operative Surgery. We alluded to this case in our first volume, and now insert the full account since published by Dr. Buck. These exsections of the knee-joint, and successfully also, are, it will be seen by the text of our author above, an old operation. Dr. Buck's, however, is one of great merit, and the *first* in this country, or in any other, for *ankylosis*, as I am assured by him.

William Keith, a farmer, of healthy and robust constitution, aged 22 years, born in Canada, was admitted September 12th, 1844, into ward No. 7, north building, New York Hospital, with the right knee *ankylosed* at a right angle, in consequence of violent inflammation and suppuration of the joint, produced by a wound inflicted seven years previous with an axe, that had grazed the bone over the inner condyle, and was followed by a confinement of seven months to the house; the limb continuing in the deformed position already noticed.

The joint was immovable though the patient imagined he was able to produce a slight degree of motion. The condyles of the femur were prominent, and stood in advance of the tuberosity of the tibia with the patella deeply and immovably imbedded between them. An irregular boney projection was observed over the inner condyle where an extensive scar marked the situation of the original wound. Several other scars of openings were visible from which matter had been discharged in the progress of the inflammation consequent on the injury, for instance, one on either side in the ham and three on the anterior and lateral surfaces above the condyles. The tendons in the ham stood out in prominent relief

from the limb. The skin and subjacent soft tissues enveloping the joint were supple and healthy. Since his recovery from the effects of the injury, the patient had enjoyed uninterrupted good health, and had been free from pain or tenderness in the knee; he had been accustomed to walk with one crutch, though sometimes he dispensed with it and stooped to accommodate himself to the shortened condition of his limb. The deformed limb was shorter and in every respect less developed than its fellow.

It was explained to the patient that from the condition of the joint, the limb did not admit of being improved in its position, by any ordinary surgical operation, but that in a few similar cases, an extraordinary operation consisting in removing a wedge-shaped portion of bone from the femur above the condyles had been resorted to with favorable results.

There being some weighty objections to this operation, it was proposed to modify it in its application to his case, and as the joint itself no longer existed in its normal condition, with secreting articular surfaces, it was judged equally safe to perform a similar operation upon the parts pertaining to the joint which, to all appearance, were free from disease.

The advantages contemplated by this modification were that more extensive surfaces of contact for bony union would be obtained, and greater strength of limb secured with less remaining deformity than was practicable in the operation of Dr. J. Rhea Barton, of Philadelphia, already alluded to, [in the next paragraph but one preceding. T.]

The patient was fully apprised of the serious nature of the proposed operation, and the dangers incident to it.

Being, however, exceedingly desirous of relief from his deformity, he decided after a few days' reflection, to submit to it. It was accordingly performed with the concurrence and aid of the other surgeons of the hospital, the 12th day of October, 1844, as follows:—

Operation.—Preparatory to the operation, the tendons of the biceps, semi-tendinosus, semi-membranosus and gracilis muscles had been divided five days before, in the usual manner, by two sub-cutaneous incisions, in doing which the peroneal nerve was unintentionally cut across and was followed by numbness and pain extending to the foot; the punctures, however, had healed and no inflammation remained in the ham.

The tourniquet having been applied to the upper part of the thigh, an incision was made from the outer to the inner condyle, across the middle of the patella, and a second incision from the middle of this, perpendicularly downwards to the tuberosity of the tibia. The included angles of integument were dissected down to a finger's breadth below and parallel with the margin of the articular surface of the tibia. The ligamentum patellæ and the fibro-ligamentous tissues on either side were cut through on the same level to the extent of nearly two-thirds of the circumference of the bone. With the amputating saw a section of the tibia was made at three-fourths of an inch below the joint anteriorly and

directed with a slight obliquity upwards so as to terminate at the margin of the articular surface posteriorly. Two-thirds of this section was accomplished with the amputating saw. The second section was then commenced through the upper part of the patella, parallel with the first, and on a plane forming an angle with it, less than a right angle, and continued to about the same extent as in the first section with the same saw. The remainder of the section through the tibia, as well as through the condyles, was completed with a metacarpal saw and chisels. The included wedge-shaped portion of bone being removed, it was found the section had not been carried far enough backwards, the posterior portion of the condyles still remaining consolidated with the tibia.

To include this a new section was undertaken, commencing upon the cut surface of the femur, three-fourths of an inch anterior to the angle at which the sections, already made, met, and directed backwards and upwards on a plane more oblique in reference to the axis of the femur. This new section being removed the remaining points of connection were ruptured by cautiously flexing the leg on the thigh, after which the irregular prominences were pared away with the bone forceps. An attempt was now made to extend the leg upon the thigh, when it was found that the boney surfaces could only be brought to within a finger's breadth of each other anteriorly. The soft parts in the ham being rendered tense and opposing great resistance to the extension, the attachments of the ligaments were dissected up posteriorly from the tibia while the leg was held in a state of extreme flexion, and, in addition to this, a further section of five-eighths of an inch thick was removed from the anterior two-thirds of the femur.

The leg could now be extended to the required degree with the boney surfaces in contact at every point, and the soft parts posterior to the joint in such a state of tension as to give steadiness and solidity to the coaptation.

The section of the condyles exceeding that of the tibia in its antero-posterior diameter, caused an overlapping in front of about half an inch. The hemorrhage was very moderate, and only two ligatures were required to small branches given off by the popliteal trunk. The soft parts posterior to the joint, and separating it from the artery were very little disturbed. The angular flaps of integument being redundant in the new position of the limb, were pared away to the required extent and secured in contact by seven sutures. The limb was then placed on an inclined plane with a slight angle at the knee, and after the patient was removed to his ward, adhesive straps were applied between the sutures and a compress of dry lint laid loosely over the whole.

The operation exclusive of the dressings occupied 40 minutes, and though very painful, was borne with remarkable fortitude.

At evening the patient had felt somewhat chilly, and on moving his arms experienced twitchings in his limbs; the knee was becoming painful; pulse scarcely accelerated; a pretty copious oozing of blood from the wound was taking place. Ordered flaxseed poultice and tinct. opii. gutt. xl, pro hausta.

October 13th.—Passed a very comfortable night, and slept after midnight; chilliness continues; pulse 112; tongue but little changed; occasional twitchings continue, and pain in the joint increases; oozing nearly ceased; scarcely any swelling has taken place; temperature moderately increased.

At 6 P. M.—Febrile reaction was fully established; pulse 120. Twenty-four leeches have been applied around the knee, and are bleeding freely. Ordered tinct. opii. gutt. xl, at bed time, and to be repeated at midnight if necessary.

14th.—Patient more comfortable; passed pretty good night after midnight; pain in the knee very much diminished; twitchings not increased; pulse 108; countenance good; has tenderness and swelling of the *lymphatic glands* in the groin; ordered cold water dressing.

At 6 P. M.—Pain in the knee had again increased; pulse 120, with pain in the head and back; bowels confined; ordered 6 leeches to the groin, and 18 to the knee around the condyles. R.—Ant. tart. gr. j; infus. sennæ comp. $\frac{3}{4}$ viij. Dose $\frac{3}{4}$ j every two hours.

15th.—Disturbed night; pain in the bowels and back; knee much easier; twitchings abated; tenderness in the groin diminished; pulse 108; tongue coated with yellowish fur in middle; knee moderately swollen without redness; only one evacuation from bowels; ordered laxative enema.

At 6 P. M.—Complained of bowels and back; pulse 108. Ordered enema of starch with tinct. opii $\frac{3}{4}$ j.

16th.—Passed a good night. Bowels easy; pulse 100; changed adhesive straps and found wound looking well without any appearance of erysipelas; suppuration commencing; at evening pain in abdomen increased. No pain in the knee; pulse 98. R.—Starch enema, with tinct. opii $\frac{3}{4}$ i. Poultice to abdomen.

17th.—Quite free from pain; pulse 96; suppuration increasing; apply poultice to knee.

18th.—A disturbed night from griping pains in the bowels, and twitchings of the limb; pain of limb referred to knee and instep; pulse 92; swelling and redness of knee moderate.

20th.—Progress favorable; pulse 92; allowed more nourishing diet; oysters, &c.; removed the last sutures.

23d.—General condition continues favorable; twitchings of the muscles are the greatest source of suffering; they are not confined to the limb, but extend to other parts of the body; two or three times they have attacked the *bowels* with great violence. Some displacement has been the consequence, so that the anterior edges of the condyles of the femur are about an inch in advance of the tibia; pulse 88; appetite good; tongue clean; bowels confined; suppuration moderate and healthy; edges of wound cicatrizing except at the angles of the wound over the condyles. Take sol. sulph. morph. gutt. xv.; aquæ menth. pip. $\frac{3}{4}$ ss, at bed time, and repeat, if necessary, ol. ricini $\frac{3}{4}$ i.

Nov. 1st.—Progress for the most part favorable; at times, pain in the knee is very severe; twitchings continue, but in a less degree; position of limb improved; less riding of the excised ends

of the bones past each other; discharge from outer angle of wound copious.

Dec. 9th.—Wound has been healed for more than a week; pain and twitchings after diminishing gradually, have now entirely ceased. Union is taking place between the bones; a slight degree of motion only is perceptible; patient's general health, after suffering considerably from protracted pain, privation of rest, &c., has been steadily improving for some time past; pulse 90; tongue clean; appetite good; bowels regular; rests well at night with only an occasional anodyne. For the relief of the twitchings from which patient suffered so much, anodynes were the most effectual remedies. Solution of sulph. morphiium was given in 15 drop doses, twice repeated at bed time, besides which he took a mixture containing $7\frac{1}{2}$ drops at a dose, at discretion, when his sufferings rendered it necessary. The limb throughout the treatment was supported on a double inclined plane, with lateral splints and pads above and below the knee.

Patient left his bed the first week in January, with the limb supported in the apparatus that is used for forcible extension of the knee-joint. At this time a slight degree of motion in the direction of flexion and extension was still perceptible, but none in a lateral direction. He was soon able to support himself on crutches and placed his foot on the floor, and, after a while, left off the apparatus and only applied a bandage. As the patient's general health improved he acquired strength in his limb, so that for two or three weeks preceeding his discharge, he walked about the hospital grounds with the aid of a cane only. The difference in the length of the two limbs was compensated for by a stirrup-shaped frame secured to the sole of his boot by means of an iron plate. The bony union at the knee, had become firm without any perceptible motion, and the cicatrix of the skin as well as the subjacent tissues was supple and movable. The only uneasiness felt from exercising was referred to the calf of the leg and instep. The difference in the length of the limbs was about 5 inches, at the heel, of which not more than one-half could be ascribed to the operation; the remainder depending on defective growth in the limb subsequent to the inflammation of the joint.

On the 22d of April last, patient took his discharge, to return home to Canada, near Niagara Falls, well pleased with the improved condition of his limb.

Three days before leaving the hospital he walked a distance of two miles with the aid of a cane only, and without pain or unusual fatigue. The accompanying drawings taken from plaster models, show the condition of the limb before the operation, (*see fig. 1.*) and at the time the patient left the hospital, (*see fig. 2.*) The full length view (*fig. 3.*) is from a Daguerreotype taken three days before his discharge. The models have been deposited in the Museum of the University of Pennsylvania, as well as [in] the pathological museum of the New York Hospital.

Fig. 1.

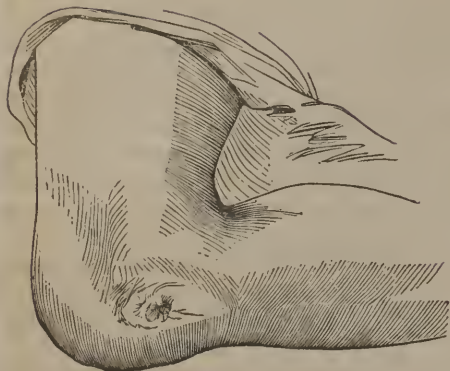


Fig. 2.



Fig. 3.*



Description of the excised bones.—The inferior two-thirds of the patella had been removed by an oblique cut from above downwards and from before backwards, and was found consolidated with the outer condyle by bony growth without any trace of the line of junction. It was adherent to the inner condyle by condensed cellular tissue. Both condyles were buried into and consolidated with the articular surface of the tibia.

The cut surface of the condyles, for the most part, presented a compact eburnated texture with only slight remains of cellular tissue interspersed. The space between the patella and tibia and behind the ligamentum patellæ was filled with condensed adipose and fibrous tissue.

No vestiges remained of cartilage or synovial membrane.

The cut surface of the tibia presented its normal cellular texture, except a single large cell capable of holding a filbert near the outer edge of the bone and having for its upper wall the thin compact shell of the articular surface. The section of the patella was also

* In the Daguerreotype from which this wood-cut was engraved, the figure was reversed, which was not observed by the Editor until the engraving was finished.

of normal cellular texture, with a similar large cell of three-eighths by three-fourths of an inch in extent. A third and much larger cell capable of containing a hickory nut, occupied the inner condyle near its articular surface. These cells were lined with a thin reddish membrane and contained an oily and fatty matter of reddish colour. Another incomplete cell was also found in the outer condyle, intersected with septa, subdividing it into smaller compartments lined and filled like the rest; none of these cells perforated the outer shell of bone, though at some points they approached very near it.

Subsequent, long-continued maceration separated the several parts from each other.

Remarks.—Though this operation was severe and protracted, the subsequent inflammation and suppuration were by no means excessive, and were confined to the parts immediately involved without spreading to a distance. Primary union of the edges of the wound took place to as great an extent as was desirable; openings remaining over the condyles at the extremities and in the middle of the transverse incision for the discharge of matter. At one time a small opening formed posteriorly in the ham, and after discharging a few days, closed spontaneously; with this exception, there was no burrowing of matter between the muscles, and at no time did the discharge exceed two ounces in 24 hours.

It had been my aim in the operation to disturb as little as possible the soft parts beyond the limits of the joint, especially those posterior to it, so as not to establish any direct communication between the wound and the loose intermuscular cellular tissue by which inflammation is so readily propagated. The long continuance of the pain in the knee and the twitchings, notwithstanding the generally favorable aspect of the parts themselves, were the principal cause of solicitude in this case.

Though the patient's condition at no time could be viewed as critical, yet his protracted sufferings, mitigated only without being controlled by anodynes, necessarily kept alive apprehensions as to the ultimate result. It may be reasonably questioned whether these painful symptoms were necessarily chargeable upon this operation or were not rather to be attributed to certain peculiarities in this case that might be avoided in another. For instance, the division of the peroneal nerve in the section of the tendons and the subsequent stretching of its recent cicatrix, together with the general state of tension of all the tissues in the ham produced by the altered position of the limb. This is more probable, from the fact that the patient complained of pain along the course of the peroneal nerve, and of twitchings of the posterior muscles of the limbs as more severe than elsewhere. In concluding this report it is due to Drs. Cook and Jones, the resident surgeons who successively had charge of this patient, to express my indebtedness for their efficient co-operation in the treatment of his case, the favorable result of which, is in no small degree to be attributed to their untiring patience and devotedness.

TRUE AND FALSE ANCHYLOSIS.

As connected with this subject of the knee, and other articulations, which may require exsection, it may be well to consider the distinction between true and false ankylosis. M. Lacroix, in a memoir (*Annales de la Chir.*, Paris, Décembre, 1843,) upon *true or osseous ankylosis*, without considering the distinctions between true and false ankylosis, or the changes that the synovial membrane and cartilages undergo, to effect consolidation of the joints, gives it as his opinion, that the true ankylosis or complete osseous consolidation, to which he confines his remarks, may be caused either by general disease in the system, or by a local affection, as caries or necrosis. These two species are, he says, to be studied in the symphysal and diarthrodial articulations. In the first mentioned articulations, the ankylosis is never *angular*. In both kinds, the ossification almost always commences in the peripheric ligaments, forming in the diarthrodial an osseous shell around the joint, with a tendency, in the greater joints, to the formation of an angle or elbow between the two bones. The ossification in general progresses from the circumference to the centre. The articular cartilages being transformed into bone, fill up the void, and this change commences rather sooner on the extension than on the flexion side of the joint. The transverse diameter of the bones diminishes, the processes for insertion around the joint then become atrophied; the osseous substance augments in volume and density at the points where it has to make the greatest sustaining efforts, that is, on the side of the concavity; from which it results, that the articulation augments in its antero-posterior diameter, while it is diminishing in its transverse diameter. Sometimes the osseous tissue subsequently becomes attenuated, and forms a medullary canal from one bone to the other; while the neighboring articulations also become immovable and ankylosed, though this does not always happen. Finally, the soldered bones are arranged together in such manner that a malady is readily transmitted from one to the other, as caries, necrosis, and tuberculous disease, (l'affection tuberculeuse.) M. Lacroix illustrates the truth of his pathology of ankylosis in all the joints by specimens from the museum of Dupuytren.

Three works have recently appeared which demand a passing notice, viz. : *On Ankylosis and Contractions from Diseases of the Joints*, by W. J. Little, M. D., Lond., 8vo, 1843. *Traité Pratique du Pied-Bot, de la fausse Ankylose du Genou et du Torticolis*, by V. Duval, Paris, 1843; and *Du Traitement des fausses Ankyloses, et de la Contracture des Membres par la Compression, &c., sans la Tenotomie*. By M. Dancel, Paris, 1843.

Dr. Little rejects a prevailing opinion, that true ankylosis, and inferentially false also, is caused by a *state of rest* or *disuse* of the limb; but believes that *inflammation* is the cause of every kind of ankylosis. He coincides in favor of the evidence furnished by Cruveilhier, Kunholtz, &c., (adverse to Cloquet,) that two cases re-

lated of complete immobility of the lower jaw, of 60 and 83 years' standing, may in reality have failed to cause ankylosis, and that thus cases of congenital club-foot, of 30 to 40 years' standing, may have the tarsal joints restored to their uses. M. Tessier, (See *Gaz. Méd. de Paris*, t. IX., p. 609 to 626,) however, in a late memoir, supports the ideas of Cloquet, and shows that long continued rest may cause vascularity of the synovial membrane, with formation of false membranes, absorption of the cartilages, and finally true ankylosis.

Dr. Little very rationally explains in what manner the muscles become permanently shorter than they are in their normal state, after the limb has been flexed for some time; because then the new or nutritive molecules in place of the natural waste of the muscles, are deposited in diminished quantities only, that is, proportionate to the approximated insertions. Hence a true interstitial or structural shortening process, (*racourcissement*.) Hence, in a certain limb, the *whole muscle* will be shortened. And thus, probably, the process continuing, the successive diminution of the amount of muscular nutrition, ends in the utmost degree of shortening possible that the bones admit of. This, of course, we ourselves should judge, would be more likely to occur in vigorous, robust constitutions of strong fibre and those habituated to much and powerful exercise. Hence, as Dr. Little remarks, such contractions more readily form in children, from the great draft on them for nutrition, and also from the bones elongating in their growth, and demanding thereby a larger supply of nutritive molecules to the muscles, whose insertions are being, by this growth of bone, separated wider apart. Hence, tenotomy succeeds better in a false ankylosis, in an adult of five years' standing, than in a child.

In the diagnosis, Dr. Little considers a sense of tightness or pain on the flexed side of the limb, in the attempt to straighten it, a mark of *incomplete* ankylosis; but the *production of pain on the opposite side*, he considers a far more delicate test, though not always certain. The alternate action of the muscles, *i. e.*, of tension and relaxation, perceivable when we attempt to straighten the limb, is another good mark of false ankylosis, and which is not produced when we use these mechanical efforts in true ankylosis. But the patient's mind must be diverted, or his voluntary tension of the muscles will deceive you. The muscular motions of the patient must be *synchronous* with our manual attempts to move the joint.

M. Duval's test, however, is better, which is to measure the distance from the ischium to the heel, while the pelvis is fixed and the limb is at rest, and then, when it is extended, and if the two measurements are equal, the ankylosis is complete; but if the latter is the longer, the case is one of false ankylosis.

True ankylosis is rare, but *false*, in the opinion both of Dr. Little and M. Duval, is almost always remediable, whatever may be its duration. Thus, Dr. Little has cured a case of 26 years' standing.

M. Duval contends, in these aggravated cases, (contrary to Dr.

Little,) that in six cases out of eight, operated upon for flexion of the knee, the patients had not the power, after the leg was in extension, of producing flexion, though the intermediate substance between the divided tendons was perfectly developed. This happens also, where the limb has been straightened by mechanical means, without preliminary sub-cutaneous section of the tendons. When the leg is extended, it *remains stiff for ever*, says M. Duval, (p. 368.) In other cases, M. Duval was more successful than in the above, as a great majority, after complete extension of the leg, recovered in whole or in part the natural motions of the knee. The less the articular surfaces are changed, the better the chances of cure. In *rheumatic false ankylosis*, Dr. Little cautions us against deception from the tissues being sometimes soldered, as it were, into a mass, from the exudation of plastic matters. These cases are more difficult than in *ankylosis from white swelling*, which he considers presents the *most favorable* form for division of the tendons.

Tenotomy is not justifiable, says Dr. Little, until two or three years after complete subsidence of the active primary disease of the articular surfaces that produced the ankylosis. Otherwise a strumous affection of the joint may thus be reproduced. But M. Duval, on the contrary, has been in the habit of operating even during the *sub-inflammatory* state of *white swelling*; for he maintains that the restoration of the articular surfaces to their normal position aids in subduing inflammation. He effects his cures in one to two months, and straightens the leg, as soon as the ham-strings are divided. Chronic ulcerations, even suppurations about the joints, must not deter us in the prompt use of the tenotome, which, at once, will often restore the parts to a healthy condition.

At the knee-joint, M. Duval has never found it necessary to divide any other structures but the *ham-strings*, and *only in one instance* has he divided the *gracilis* muscle. The division of the *biceps* alone is occasionally sufficient, especially when the ankylosis is complicated with deviation of the knee inwards. But it will be sometimes found, that after the lapse of fourteen or fifteen days, when the extension of the leg has made considerable progress, that the tendons of the inner ham-strings become prominent and must be divided. Dr. Little, however, has often, like most practitioners, been obliged to divide, not only the above muscles, but also the interior fibres of the *vastus externus* muscle, *bands of fascia in the ham*, and on the *outer side of the thigh*, and the tendon of the *sartorius*. Dr. Little cautions against wounding important nerves, as he saw was done in one patient. He has also seen the *peroneal* severed by mistake. Still, he advises in some instances the division of the more superficial of the nerves which supply the gastrocnemii. They will be felt to the number of *one or more tense* painful cords, and the division will aid the cure, and prevent neuralgia, &c.

Dr. Little differing from M. Duval and the French generally, recommends not to make *immediate* extension, but to wait till the

punctures are cicatrized, about the fourth or fifth day, otherwise an abscess may happen in the ham, and the divided ends of the tendons not acquire sufficient vascularity to effect a union by the intermediate plastic lymph. If a second division becomes necessary, he recommends that it be postponed to two or three weeks.

A mechanical apparatus is particularly serviceable where the head of the tibia is rotated or partially luxated backwards on the condyles of the femur, for displacement of the head of the tibia may also ensue from the efforts alone used to effect extension. To remedy lateral displacements of the head of the tibia, Dr. Little uses an apparatus with pads fixed to screws for this special purpose. When the head of the tibia is thrown backwards, his apparatus is so contrived as to constitute the pelvis a fixed point. He then makes such extension from the ankle and the foot as will not only extend the entire limb, "but elongate to such an extent the ligaments of the joint and other structures exterior to it, as will enable the tibia to rise into its position,"—the ankle being drawn inwards to remove any eversion of the foot. M. Duval makes no pressure on the knee, and after extension is effected, prefers an orthopedic bed a few hours each day. After extension is completed, M. Duval relies for the restoration of the motions of the joint, on the efforts of the patient himself, while Dr. Little had recourse to passive movements, frictions, vapor baths, the occasional use of the extension apparatus, afterwards an iron on the outer side of the limb, with a spring to support the weak extensor muscles of the knee; also a lead knee-cap.

In ankylosis of the *hip-joint*, after all apparatus has failed, the division of the muscles, Dr. Little says, should be postponed to two or three years, that is, to the period when the previous original disease shall have entirely subsided; but in the meanwhile, the apparatus should be worn to prevent aggravation of the deformity. In ankylosis and contraction at the hip-joint, the prognosis should be cautious, as it is more difficult here to ascertain the changes of structure that have taken place. Dr. Little has divided the parts with benefit in five cases. In a boy aged nine and a half years, who, in consequence of a fall, had the right hip contracted from the age of three, the knee being much drawn up towards the abdomen, and the thigh rotated inwardly, Dr. Little divided the more prominent muscles, viz.: the tendons of the *rectus femoris*, origin of the *pectineus adductor longus*, and part of the *adductor magnus*. On the third day, the punctures were cicatrized, and the thigh could be depressed about four inches; in two months after, he could walk well, and without crutches, the shortness of the limb, however, and some flexion still remaining.

M. Dancel, in his work, denies that the contracted muscles in *angular ankylosis*, are really or organically shortened; however rigid they may be, he says, it is merely spasmodic contraction, *i. e.*, a *nervous affection*, curable by compression and extension. But many of M. Dancel's cases were only muscular spasm from cold, contraction of the biceps after venesection at the bend of the arm,

&c. His method is a roller applied with powerful compression to the part of the muscle affected for a few minutes, so as partially to *paralyze* the muscle ;—afterwards extension is practicable, and then splints are applied to retain the limb in this position. (See *London British and Foreign Medical Review*, No. XXXVI., October, 1844, p. 353 to 364.

M. Lacroix (*Op. cit.*, *Ann. de la Chir. Franç. et Etrang.*, October, November, December, 1843 ; vid. also *Gaz. Méd.*, tom. XII., 1844, p. 189) in the memoir on ankylosis, quoted above, says where it affects a symphysis, the ligaments first attacked by the deposition of osseous matter are those which correspond to the convexity of the joint. The ossification of ligaments proceeds from the centre to the circumference. The articulating cartilage ossifies first on the convex surface. Most of the osseous matter is deposited in the angle of the ankylosis, though that was the last to be attacked. Rupture must not be attempted where the ankylosis has augmented in its antero-posterior diameter, as the resistance is then greatest on the line of the articulation. T.]

ARTICLE IV.—THE PATELLA.

If the patella alone were carious or degenerated, it should be removed without any hesitation, though we should have to open into the articulation. The *Journal of Hygie* contains an example of this kind, and the patient, it is said, was perfectly restored. I have seen two persons, who walk sufficiently well, though the fragments of their patella, which had been formerly fractured, leave an interval between them of more than four inches. M. A. Séverin, (*Méd. Efficace ; Corps de Méd. de Bonet*, t. I., p. 313, § 953,) being consulted by Father Mathias, who was unable to go up and down stairs, from his patella (palette) having been fractured several months before, answered, that there was no other remedy, unless after having made an incision through the integuments, the fractured surfaces of the patella should be abraded, (*sinon on vint à renouveler la fracture des bords de la palette*,) and afterwards bound tight together, (*bien serrés les uns contre les autres*,) adding, that this process was rude and unpleasant, but nevertheless necessary if he wished to recover promptly the function of the foot. But the patient refused to comply with this advice, and did well.

In the museum of the Faculty of Medicine of Strasbourg, there is a skeleton in which the knee had no patella, (*Musée de Strasbourg* from 1820, p. 106, No. 219.) “I saw some years since,” says Diemberbroeck, (*L'Anatomie du Corps Humain*, t. II., p. 683, ch. XIX.,) “a German gentleman, whose patella was carried away entirely by a musket ball, and who thereby wholly lost the ability to walk. He was, nevertheless, in some sort restored here, in our village of Utrecht, by an artisan who applied to the knee an apparatus constructed of iron, by which the thigh bone was bound down and kept united to the tibia ; so that when this instrument was adjusted, he could walk tolerably well. Nor could he ever, from the

moment he laid it aside, advance the foot to make a single step, or even support himself a single instant."

In the following case they went farther:—The patella was fractured longitudinally, and the attempt at reunion failed; swelling and tension of the whole thigh, leg and foot succeeded, with apprehension of speedy mortification. Gelée (*Journ de Méd. Milit.*, par Dehorne, t. IV., p. 503) being sent for eight days after the accident, judged that it would not be advisable to count on topical applications. Though the parts were dilated by incisions which specially implicated the tendinous and ligamentous attachments of the patella, the progress of the disease was not thereby arrested. The fever placed the life of the patient in imminent peril. Having remarked, says Gelée, that the strangulation was owing to the two portions of the patella, from their constant tendency to separate, drawing each of them respectively on the attachment of these bones, "I looked upon them as a double cause of the accidents which would not terminate unless one of the two portions was extirpated." One appearing to be sufficient to maintain (contenir) the articulation, he removed the smallest portion, which was that on the outer side. The results of this singular operation proved successful. The swelling obviously diminished, and on the eighth day, it had quite subsided, (il était très ordinaire.) The cicatrix was completed in six weeks, with permanent extension of the limb by ankylosis, (avec ankylose du membre étendu.)

The fear of placing the articulation in contact with the air, was the reason why Theden (*Progrès ultérieurs de la Chir.*, p. 138) disapproved of amputation of the patella, "which was unfortunately performed," he says, "in a case of gun-shot wound, since it resulted in gangrene and death." We have seen, says Percy and Laurent, (*Dict. des Sciences Méd.*, t. XLIII., p. 65) the patella separate itself from the knee, and have more than once removed it entire, without the patient having thereby lost the ability to walk. "If a dislocated (renversée) patella could not be reduced, I would recommend," says Manne, (*Traité Élém. des Mal. des Os*, p. 347, 1789,) "that it should be removed, by making a longitudinal incision in the integuments which cover it, and then dividing transversely above the base of the patella the tendon of the extensors of the leg, the ligament which attaches the point of this bone to the tibia, together with the membranous and aponeurotic portions which are adherent to its lateral surfaces. The extraction of the patella having been effected, the lips of the wound should be brought together, or kept approximated to each other, by maintaining for a length of time, the leg extended and the thigh flexed by means of suitable dressing." This operation, it would appear, was successfully performed in 1835 or 1836, by M. Thyron, a surgeon of Belgium.

ARTICLE V.—HEAD OF THE FEMUR.

White, (*Cases in Surgery*, 1770; or *London Med. Gazette*, March,

1832,) having, it is said, about the middle of the last century, removed the head and four inches of the femur in a child of fourteen years of age affected with coxalgia, and cured his patient, ventured to propose this operation as one that ought to be adopted in analagous cases. A simple incision on the outside of the thigh, enabled him to lay bare the articulation, open the capsule, luxate the bone, and bring it to the external surface in order to perform its exsection. Vermandois (*Journ. de Méd.*, t. LXVI., p. 49, 1786) and Petit-Radel (*Encyclop. Méth.*, part. *Chir.*, t. I.) revived this suggestion without modifying it. But Rossi (*Méd. Op.*, t. II., p. 225) soon perceived that the incision proposed by White would not answer, and that in order to arrive at the articulation, it was advisable to cut a triangular flap upon the outer side of it. Chaussier, (*Soc. Méd d'Emul.*, t. III., p. 399,) about forty years since, undertook a series of experiments upon this subject and upon exsections in general. According to him excision of the head of the femur in dogs is not much more dangerous than that of the humerus. There forms in place of the excised bone a fibro-cellular matter which afterwards becomes cartilaginous, and ultimately acquires a solidity almost equal to that of the osseous substance. Wachter in his dissertation maintains nearly the same opinions.

In 1831 I knew of but a single example of exsection of the coxal extremity of the femur practised on living man. At that time I confined myself to the following language: "If the head of the femur should have escaped through the lacerated soft parts, and it became impossible to reduce it, we could unquestionably and ought to remove it with the saw, especially if it were fractured; but what disease is there of so grave a nature as to require exsection of the bones, or that could attack this point without being propagated to the cotyloid cavity; and when the bone of the pelvis is implicated, what advantage would there be in exsection of that of the thigh? If, however, it should ever be decided upon to undertake it, the most simple process, supposing that there was no wound at the exterior, would consist in cutting, by means of a semi-lunar incision, extending from the anterior superior spinous process of the ilium to the tuberosity of the ischium, a large flap with its convexity downwards and behind the articulation, at the expense of the tissues at the root of the limb. After the surgeon has raised up this flap and divided the posterior half of the capsule, he would be enabled by bringing the thigh into adduction and flexion, to divide the inter-articular ligament, to insert the knife between the head of the femur and the cotyloid cavity, and to arrive on the inner side and in front upon the gorge of the neck of the femur, in order to detach from it what remains of the capsular ligament, and to bring out of the wound the whole of the portion of the bone we wish to remove. Nothing afterwards would remain to be done but to place the thigh back to its natural position, bring down the flap to secure it with the suture or adhesive straps, and to proceed in other respects as in compound fractures of the upper portion of the thigh bone."

At the present day I must speak in other language. A young

girl, affected with coxalgia, had the haunch perforated with fistulas. The head of the femur having become movable, says Vogel, (*Bibl. Chir. du Nord*, p. 391, 393,) was extracted, and the child got well. In the case of another girl, aged fourteen years, mentioned by Schlichting, the opening of a pre-existing abscess was enlarged and the head of the femur then exsected with success. Are these the same, or other cases of destruction of the head of the femur, than those related by Ficker and Albert, (Wachter, *De Art. Extirp.*, etc.) According to M. Leopold (*Über die Resection*, etc., Wurtzburg, 1834,) this exsection has also been performed successfully by Kohler and M. Heine, of Wurtzburg. M. Schmalz, (Hedenus, *De Femore in Cavit. Cotyl. Amput.*, 1823,) of Pirna, in Saxony, also removed the carious head of the femur which had already separated from the rest of the bone. The boy was three years in getting well; the new articulation being formed by the great trochanter. M. Kluge (Wagner, t. IV., *de l'Encyclopédie de Bush*, Graefe) has also exsected the head of the femur in a state of caries; but the patient died two days after the operation. Brandisch (Simmons, *Journal de Médecine*, translated from the English, t. VI., p. 114, 1786) has also published the following case:—A wound of the thigh from a fire-arm. A portion of the head of the femur, representing about the whole extent of its upper half, came away in exfoliations. The patient got well. The limb which was scarcely any shorter than the other, could be brought into extension, and the patient use his limb, so as to walk with ease by means of a crutch. In the case of Schlichting, (*Transact. Philos.*, p. 284, No. 466, 1742; *Bibl. Chir. du Nord*, p. 392,) the cure was accomplished in six weeks, and the patient could walk with ease, but not without limping. M. Hewson, of Dublin, (Leopold, *Op. cit.*, p. 16,) in the year 1823, in a case of caries, adopted the process of White, and exsected the head of the bone above the little trochanter. The patient died three months after the operation in consequence of purulent collections, which extended from the cotyloid cavity by means of an opening, into the pelvis. M. Sentin (*Bull. de Thér.*, 1833; *Gaz. Méd.*, 1833, p. 165) in the year 1832, exsected the head of the femur, in a case of comminuted fracture from a cannon ball. The patient died in consequence of gangrene of the soft parts. It would appear also that M. Oppenheim (Leopold, p. 17, *Gaz. Méd.*, 1835, p. 183) once performed this operation at Schumla. Jæger and M. Textor (Leopold, *Op. cit.*, p. 17) also had recourse to it in 1834, at Wurtzburg, in the case of a boy aged seven and a half years, and who had fracture of the neck of the femur with abscess. The head and neck of the femur were removed, with two inches of the great trochanter. The child died at the expiration of twenty-three days. According to M. Jæger, exsection of the femur would be indicated: 1, In cases where there were splinters of the neck and head of this bone or of the great trochanter from wounds of fire-arms; 2, In cases of fracture of the neck of the femur where suppuration and caries have supervened; 3, In cases of dislocations complicated with fracture and laceration of the soft parts; 4, In

cases of ankylosis of the articulation where the limb could not be made use of; 5, In caries of the head of the femur in consequence of coxalgia, nor would it be contra-indicated then except there was at the same time caries of the cotyloid cavity or of the pelvis in general, and extensive purulent collections along the course of the femur.

§ I.

Leopold describes the operative process in the following manner; the patient is laid upon his sound side and the operator places himself behind him.

A. *First Stage*.—The articulation is laid bare, 1, by a simple longitudinal incision on the outer side of the haunch, or upon the trochanter itself, as was done by White, Park, Vermandois, MM. Hedenus, Syme and Seutin; or 2, by a semi-lunar incision going round the great trochanter, as recommended by Jæger, and as I have mentioned above, or by dividing the gluteus maximus muscle, as recommended by Hewson, who also cut a semi-lunar flap about the great trochanter; 3, a posterior square-shaped flap, situated upon the outer part of the articulation, would be preferred by Percy and M. Roux; Jæger, who commences by a longitudinal incision at two inches or two inches and a half above the great trochanter, and which is to descend to three inches below it, adopts a triangular flap of five to six inches in length, which he completes by another incision of four inches in length, placed posteriorly and below in such manner as to divide the insertion of the muscles on the antero-superior part of the trochanter, while opening into the capsular ligament.

B. *Second Stage*.—The head of the femur is most usually removed by means of the common saw; but in muscular patients Heine's saw would present some advantages.

C. *Third Stage*.—*Dressing*.—According to Jæger the union of the wound by the suture or adhesive plasters, and dressing with lint, compresses and a spica to the groin are injurious. This surgeon leaves the wound untouched, or unites it only at one part by a suture, and applies to it cold fomentations. The patient is to lie upon his sound side, with the femur and leg slightly flexed.

§ II.—Appreciation.

Without recurring to what I have said of it at first, or adopting in every particular the favorable opinion which Jæger has of this operation, and of which the thesis of Leopold appears to be an exact transcript, I will say then in conclusion, that exsection of the head of the femur stands in the same relation to disarticulation of the thigh, that that of the head of the humerus does to disarticulation of the arm. The modifications of the process also must be the same in both cases. Moreover, if White is in reality the first who recommended it, I am not sure that M. Coulon and Leopold have not, in the cases they attribute to this author, confounded the recom-

mentation with the fact of the operation. To illustrate the effects of this exsection, experiments have also been made upon dogs by Vermandois, (*Ancien Journal Méd.*, t. LXVI., p. 74,) Kohler, (*Exper. circa Regener. Ossium*, Goett, 1786, p. 84 et 94, Exp. XIV. et XV.) Chaussier, (*Magasin Encyclop.*, an V., t. VII., p. 248,) and by Wachter, (*De Articulis Extirpandis*, p. 91—94;) upon which subject Vermandois, (*Ancien Journ. Méd.*, t. LXVI., p. 70, 1786,) Rougemont, (*Bibl. Chir. du Nord.*, 1788, p. 392,) Petit-Radel, (*Encyclop. Méth. Dict. de Chirurgie*), Rossi, (*Médec. Op.*, Turin, 1806, t. II., p. 224,) Wachter, (*Œuvr. cité*, p. 85,) Briot, (*Hist. Chir. Milit.*, p. 177, 1817,) Jæger and Kluge, (Coulon, *Sur la Carie*, p. 41,) MM. Seutin, (*Œuvr. cit.*, p. 41,) Coulon, (*Œuvr. cit.*, p. 177, 178,) and Baudens, (*Ibid.*, p. 124,) are subsequent to White.

Briot, (*Ibid.*, p. 88,) who supposed that the idea of the operation first originated with him, and who wished to perform it on a child of thirteen or fourteen years of age, proposed to cauterize the caries of the cotyloid cavity, after having removed the extremity of the femur. M. Syme (*Hist. de la Chir. Milit.*, p. 177, 1817) regards the operation as altogether useless in cases of coxalgia, for he admits with me, that the cotyloid cavity almost always diseased at the same time, is generally affected to a greater extent than the femur. Moreau, the father, however, with the hope of removing the carious portions of the cotyloid cavity by means of the chisel and gouge, proposed to two patients, in presence of M. Champion, to perform upon them the operation of exsection of the femoro-iliac articulation; but they refused and recovered.

White, Vermandois, Petit-Radel, and Wachter, who assert that the touch in such cases is as sure a guide as the eye, confine themselves to a single incision. "The following, says Briot, is the method I projected for this operation: I would have made at the upper and outer part of the thigh a long and deep incision, the borders of which I would have held apart, and if necessary divided. I would have laid bare the upper part of the femur, divided transversely the capsule and triangular ligament, examined the condition of the great trochanter, and respected the tendons which are inserted upon it, if I had found it sound; in the contrary case I would have divided those tendons, directed the knee inwards and the upper part of the thigh outwards; then with a small saw would have exsected the whole of the diseased portion of the bone. If I had found the cotyloid cavity carious or diseased, I would have immediately cauterized it; afterwards I would have endeavored, by means of the dressing and a bandage methodically applied, to place the femur in connection (*en relation*) with the tuberosity of the ischium, with which I would have endeavored to make it contract an artificial articulation."

Rossi (*Méd. Op.*, t. II., p. 224) prefers a flap in L and not in V. M. Montfalcon (*Mém. sur l'Etat Actuel de la Chir.*, p. 103, Paris, 1816) also prefers this form of incision. M. Roux (*De la Résection ou du Rétranch. des Portions d'Os Malades*, p. 49, Paris, 1812, in 4to) thinks that here, as at the shoulder, there is no necessity of

economizing space; and that it would be preferable to make outside of the articulation a large square-shaped flap, (large lambeau carré,) adherent by its upper border in the same manner as Voehler or Puthod, and all those who have described the extirpation of the thigh before the time of M. Larrey, proposed that it should be made for this last mentioned operation. Percy (*Dict. des Sciences Méd.*, t. LXVII., p. 554) also recommends a square-shaped flap, and M. Champion has often seen Moreau, the father, go through the manipulation of exsection of the head of the femur, by means of an enormous (vaste) quadrilateral flap, formed upon the outside. But the semi-lunar flap which I have recommended, and which M. Bégin (*Nouveaux Elém. de Chir.*, Paris, 1838, t. II., p. 821) adopts, is I think preferable to all the above forms of incision.

[GENERAL SUBJECT OF DISARTICULATIONS AND EXSECTIONS.]

Operation of Disarticulation and Exsection of the Lower Jaw.—New Modification Proposed by M. Chassaignac.—M. Chassaignac, of Paris, in a memoir which he read April 17, 1844, before the Society of Surgery of that city, (see *Archiv. Gén. de Méd.*, Janv., 1845, p. 46, etc.) states that he had been in the habit of teaching for years the propriety of making a new modification in the process employed for temporo-maxillary disarticulations; based upon anatomical observations which he had made, that the condyle and coronoid process of the lower jaw are often found to vary much in their relative length, the condyle sometimes being in excess, and occasionally the coronoid process extending upwards as much as an inch above the level of the condyle. Where this latter arrangement especially exists, he proposes that we should, before proceeding to disarticulate, make a previous exsection of the coronoid process at its base, by means of Liston's cutting pliers, (pince de Liston,) for the following reasons: 1st, the tedious manipulations required to detach or dissect around this process by the bistoury; 2d, from the great depth we are obliged to go into the zygomatico-temporal fossa, and the difficulty which attends this part of the operation; 3d, from the necessity of groping our way in the dark, owing to the point of the bistoury being frequently out of sight; 4th, from the point of the bistoury, in consequence of the necessity, when the coronoid process is of great length, of cutting the parts parallel to it, being thus placed in the most unfavorable position for dividing the opposing aponeuroses and tendons, which, so to speak, encase (emmaillotte) the whole of this process; 5th, from the difficulty which exists, in consequence of the condyle being still fixed in its articulation, of executing those manipulations required for the section of the temporal [muscle.]

M. Chassaignac declares it, moreover, as his unqualified opinion, that the *most difficult*, and in fact the *only difficult part of the operation*, in every case of this kind, is the section of the coronoid insertion of the temporal muscle.

After the section of the coronoid process at its base by Liston's

pliers, we should then, he says, proceed to the disarticulation of the condyle, and terminate where it is necessary, by exsecting the remaining portion of this process. The operation is not, he says, in itself, of great importance, but is enhanced, in his eyes, from its being one of the numerous applications of the principles which he has taught for many years, on the subject of *articular exsections*. The following are his general rules, which he adopts, without exception, in all articular exsections: 1st, There should in general be only one incision of the skin, and that *rectilinear*, but only in some cases *curvilinear*; 2d, In every articular exsection, the section of the bone which is to be disarticulated, should precede the disarticulation itself; 3d, Whether two or three bones enter into the articulation or not, we should always commence with the exsection of that which can be disarticulated with most ease. The exsection and disarticulation of one facilitates the exsection and disarticulation successively of the others.

The single incision of the skin is dependent for its success upon the previous exsection of the bone before disarticulating it, showing that the first and second rules are inseparably united.

In respect to the *curvilinear* incision, we must remind the student that the exceptional manner in which it is spoken of by M. Chassaignac, in comparison with the straight incision, is entirely at variance with the opinions of Dr. Mott and of our author, M. Velpeau. (See their Letters in the Prefatory matter to Vol. I. of this work.)

The T incision proposed by M. Roux, for exsections of the elbow joint, in lieu of the usual H incision, meets with the approbation of M. Chassaignac. This surgeon deems the introduction of the *elevator*, (tire-fond,) as suggested to him by M. Vidal, (de Cassis,) [*Gaz. Méd.*, 1840, p. 582.] as an event of great importance in all these exsections. It should, he says, be slightly sharp, and mounted with a straight or trephine handle. This pry or elevator being implanted into the portion of bone to be disarticulated, (*i. e.*, the spongy tissue of its articulating extremity,) furnishes the arm of a lever, which aids the operator to a remarkable degree. Two applications of it are generally all that are requisite.

The *claw-forceps*, (pince-à-griffes,) provided with a strong handle or the dentist's crow-foot, (davier,) may answer equally well for some exsections. (See Chapter on the Teeth, Vol. I.)

The *chain-saw* is also an instrument almost always indispensable. M. Chassaignac states that a useful modification of M. A. Cooper's aneurismal needle for conducting this saw, is to have the eye of a broad oval (œil-de-perdrix) shape, which, he says, greatly facilitates the introduction of the saw, which is attached to this needle by a thread, through the narrow passages where we are sometimes obliged to insert it.

An innovation of some importance, which M. Chassaignac has made in these processes, and which, though apparently one that is

well-founded, requires certainly to be extensively tested before its general adoption, is that modification which is embraced in general terms under his third rule above. To explain this more fully, he says that where there are a number of bones entering into the same articulation, each extremity of bone should be separately and successively exsected and disarticulated, before proceeding to the others. This mode, he remarks, requires an external incision of *much less extent* than disarticulation in mass, or the double section without disarticulating, [*i. e.*, the exsection, for example, of two osseous extremities at once, and not their separate exsection and disarticulation, as seems more properly to be recommended by M. Chassaignac.]

In the application of the above principles, M. Chassaignac proceeds to treat successively of exsections and disarticulations of various bones :—

1. *Exsection of the Clavicle.*—Here, also, we believe the author will be found almost alone in the application of his principles; for he proposes, by means of an incision parallel to the clavicle, to *isolate the middle portion of this bone, to divide it at this point with the chain-saw; and then to terminate, by the separate and successive extirpation of each extremity, rendered thus independent by the section of the bone into two portions.*

It must at once strike any surgeon, who is in the least acquainted with the parts situated in the immediate vicinity of the posterior surface and middle portion of the clavicle, that a tedious jarring, tearing, or lacerating manipulation of this kind, with the teeth of the saw, where the *whole bone* is to be disarticulated, which exsection was *first* performed by Dr. Mott, must be exceedingly painful and dangerous, and altogether an unnecessary complication super-added to a process in which the knife only is requisite, and far more prompt and infinitely less dangerous.

2. *Exsection of the Acromion.*—Here he prefers a *semilunar* incision with the convexity downwards, instead of crucial or T incision. The acromion is thus laid bare through its whole extent, and first exsected by passing the chain saw under its neck, (*pédicule*), after which it is disarticulated with the greatest ease.

3. *Exsection of the Head of the Humerus.*—First a long vertical incision on the middle portion of the deltoid, down to the lower attachments of this muscle; the passage of the saw around the surgical head of the humerus and the section of the bone. In the dissection which precedes the section of the bone, M. Chassaignac, is always particularly careful to detach the tendon of the biceps from the groove in which it is so strongly bound down, this being perhaps, he remarks, the most difficult part of the operation, and one which should not be neglected for these two reasons: 1, as a general rule in all exsections, no tendons should be divided but those whose section is indispensable for the completion of the process; 2, if by chance the chain saw should happen to include the tendon in place of passing between it and the bone, great embarrassment might result to the movements of the saw. After the section of the hume-

rus is effected, the surgeon turns back the upper fragment of this bone, and seizing it by the instruments already mentioned, extracts it by dividing the tissues at its lower part first.

4. *Exsection of the Elbow-joint, (coude.)*—A single straight incision on the outer and a little to the posterior surface of the joint; by which means both the radial and ulnar nerves are avoided; first the radial, because the incision reaching to four fingers' breadth above the articulation, its superior extremity falls below the oblique groove in which the radial nerve courses on the posterior surface of the humerus, while this same nerve cannot be wounded on the outer side because the incision falls slightly on the posterior surface of the arm. The facility with which each bone can be successfully exsected and disarticulated, enables us to detach the ulna nerve from its groove, without any danger of wounding it with the bistoury.

The longitudinal incision having been made, the upper extremity of the radius is isolated, divided easily by the chain saw, and then disarticulated; the inferior extremity of the humerus is then isolated by dissection at a greater or less distance above the articulating surfaces, after which it is exsected by the same saw. All difficulty now ceases, from our having it in our power to turn this extremity of the humerus out of the wound, and to detach it from the soft parts, and especially from the ulnar nerve. We now proceed to the disarticulation and removal of the trochlear extremity, (*i. e.*, the inner articulating surface) of the humerus; then to the isolation and section of the acromial, (*olécrânienne*) extremity of the ulna.

5. *Exsection of the Wrist.*—Longitudinal incision on the inner side of the articulation; section and disarticulation of the inferior extremity of the ulna; passage of the chain saw around the lower extremity of the radius; section and disarticulation of this bone.

6. *Exsection of the Metacarpal Bones.*—One incision on the back of the hand parallel to the metacarpus which is to be exsected; *section of the bone at its middle part*, then the separate disarticulation of one of its extremities, *or of both successively*.

The same objections to M. Chassaignac's method will be urged here against the central section of a metacarpal bone when both its extremities are to be disarticulated, as those which we have already stated, against his mode of disarticulating the whole clavicle.

7. *Exsection of the Femur.*—This may be made at two points, either directly on the neck below the head, or below the trochanter: for both he uses the curvilinear incision, with concavity forwards, including the posterior part of the great trochanter; isolation by dissection either of the neck or upper part of the bone, below the trochanters; passage of the chain-saw, and then disarticulation. To introduce the chain-saw in this exsection requires a needle of very large curvature.

8. *Exsection of the Knee-joint.*—A long incision on the side of the articulation; isolation and section of the fibula at the neck of this bone, then the disarticulation of its head; passage of the chain-saw

around the lower extremity of the femur ; section and disarticulation of this bone and afterwards the exsection of the tibia.

It does appear to us, that the same serious objection, but to a greater extent, and in a reverse order, lies against this process of exsection of the knee-joint by M. Chassaignac, that we have urged against that of the entire clavicle and of an entire metacarpal bone. Here notwithstanding the femur has been exsected, the surgeon proceeds to the tedious unnecessary process, and certainly, although the parts are to be ultimately removed, one which for the time being is a dangerous, if not painful operation, of penetrating the vast articulating surfaces of the joint, and dividing its numerous and strong ligaments, before exsecting the tibia below, which to us would appear to be the only remaining step required to complete the operation. In ankylosis of the joint of course such a process would be impossible. (See *Exsection of the Knee-joint and Elbow*, Vol. I. of this translation of M. Velpeau ; also this Vol., *supra*.)

9. *Exsection of the Articulation of the Instep*.—A long incision, slightly curved at its inferior third, is to be made on the outer side of the articulation ; then section of the fibula with the chain-saw ; disarticulation of the inferior extremity of this bone ; passage of the chain-saw around the inferior extremity of the tibia, and the section and afterwards disarticulation of this extremity.

10. *Exsection of the Metatarsal Bones* is performed by M. Chassaignac in the same manner as for the metacarpal, and therefore liable as we conceive, when an entire bone is to be removed, to the same objections, if not greater from the bones of the metatarsus being so much larger, and the concussion therefore produced by their totally unnecessary section by the saw, much greater on the system.

In *recapitulation* M. Chassaignac enumerates the general advantages to be obtained from his process as follows :—

1. Less destruction of the soft parts, as a single incision answers for every kind of exsection, and that it need not be carried to a greater extent than the principal one of those which are made when several incisions are employed. The deformity resulting from numerous lines of cicatrices, is thus avoided. This remark certainly does not apply to the obvious superiority to be obtained by the single long curvilinear incision of Dr. Mott, and M. Velpeau, when the whole or nearly the entire lower jaw is to be removed. (*Vid. Vol. I., Loc. cit.*)

2. A notable saving in the most difficult part of the operation in exsections, viz., is that in which the articular extremity is to be removed from the bone which is to be disarticulated. This is made easy when the bone is sawed before disarticulating it ; because we obtain by means of this previous section, an osseous portion of a moveable extremity, upon which we may exercise in every direction the movements that are most convenient to effect its disarticulation (*énucléation*.)

3. A curtailment in the time of the operation, and dissections less extensive.

4. A much greater facility in the coaptation of the lips of the wound ; which to a greater or less extent increases the chances of primitive reunion, and in every case may abridge the period of ultimate cure.

5. We avoid the division of many nerves, tendons, and vessels, because the incision being almost always longitudinal, that is to say, parallel to the axis of the limb, it runs also in a direction parallel to the track of those different organs ; while, in the ordinary processes, with transverse incisions, we are incessantly exposed to the danger of dividing important nerves, vessels, or tendons.

6. In some cases, before proceeding to the operation of exsection, we cannot know with precision what will be the extent of bone required to be removed. If we ascertain that this portion has but very little extent, we have made at least but one incision, and the division of the parts is much less than where there are several. [All this is very true where the extent of degeneration is limited, and we are not well assured that the whole or greater part of the bone requires removal.] It is, says M. Chassaignac, for the same purpose of avoiding this laying open and breaking up (*morcellement*) of the soft parts, that in trephining, I have substituted the curvilinear or V incision in place of the crucial. It is to be remarked, also, that in commencing with a single incision, we may always, when necessary, unite a second or third to it.

Remarks.—In the formal report made by MM. Laugier, Vidal, and Robert, the commission appointed by the Society of Surgery to examine the memoir of M. Chassaignac, (*Archiv. Gén.*, loc. cit., p. 54,) they express their doubts as to the propriety of exsecting the coronoid process of the lower jaw before disarticulating the condyle ; because, in regard to the presumed difficulties of reaching and detaching the coronoid insertion of the temporal muscle, growing out of the greater length which he supposes it to have, they assert that they have not found this anatomical fact to be generally true, but, on the contrary, that this process is generally shorter than the condyle ; and as it usually reaches only to the lower border of the zygomatic arch, its apex may, especially when the jaw is depressed, be easily reached with the bistoury or scissors. But, say the commission, it is known that, when we propose to perform the temporo-maxillary disarticulation, the external soft parts having been divided, and the masseter muscle detached from the bone at its lower extremity, it is a rule to saw vertically through the body of the jaw-bone upon any given point of its length, then to depress it forcibly, which allows of an easy division of the temporal muscle, then to turn it backwards and outwards ; and after this, to detach the internal pterygoid muscle, and complete the disarticulation. They, therefore, consider that the process of M. Chassaignac would be a useless complication of a process which is already long and laborious, and requires abridgment, except when the surgeon is obliged, from the abnormal elongation of the coronoid process, to exsect it before disarticulating the condyle.

M. Robert, however, the reporter of the commission, states the

important fact, that in order to ascertain how often such an anomaly of length in this process as that mentioned by M. Chassaignac might possibly exist, he visited the rich collection of heads of all ages and races in the anatomical amphitheatre of the hospitals, and found that *out of three hundred*, there was *one only* in which this process had an unusual length, and which reached only one centimeter and a half above the line of the condyle. In two others it reached about one centimeter higher; in all the rest, its apex was found at the same height as the condyle, or even a little below it. Therefore, the cases are too rare to authorize a modification in the usual process.

In regard to the process of M. Chassaignac, as applied to excisions in the continuity of the bones, the commission bestow upon it their commendation—M. Laugier, as he had already done, (*Bulletin Chirurgical*, Octobre, 1840, p. 97,) dissenting from the encomiums bestowed by the author on the elevator.

A very just ground of objection, as we conceive, made by the commission, to the process as applied to the upper extremity of the humerus, is this: that, by first disarticulating the head of the bone, we may generally ascertain, from its condition, the extent of degeneration, and consequently the length of the portion required to be excised; whereas, by M. Chassaignac's mode, the excision preceding the disarticulation, we should be liable constantly to remove too much or too little.

In respect to the difficulties which M. Chassaignac states exist in getting under the acromion to divide the capsule, and which, perhaps, have reference to the process of Whytt and others, M. Robert gives a method which he himself has adopted, and which he thinks obviates those objections: thus he commences his incision, *not* from the outer border of the acromion, but from the outer border of the clavicle, opposite to the acromio-coracoid space, directing it downwards and outwards, parallel to the axis of the arm, passing between the fibres of the deltoid muscle, and dividing the acromio-coracoid ligament; we then penetrate directly and immediately into the articulation, by which it becomes easy to divide the capsule, to evert the head of the bone, and excise it at the proper place. The commission, concurring with M. Robert's mode, disapprove of that of M. Chassaignac.

In respect to the elbow joint, the commission appear rather to object to the length of the incision, and especially to the difficulty of isolating the ulnar nerve at the deepest part of the wound, particularly where the tissues are deformed, tumefied, and indurated. The same objection to the length of the incisions and possible alteration of parts to a great extent, appears, in their opinion, to lie against the process of M. Chassaignac, as applied to the lower extremity of the fore-arm and leg. They prefer incisions of the length and number only required, and made in such way as to lay open the diseased parts freely, but to preserve the important organs about the articulation.

So that the commission conclude in dissenting, in general terms, from the processes recommended by M. Chassaignac.

SOME CASES OF PARTICULAR FRACTURES AND DISLOCATIONS.

As the subjects of Fractures and Disarticulations are not distinctly treated of by our author, as we have before said, but solely in connection with EXSECTIONS, we will insert here a few cases of this kind, which have occurred since the publication of his work, and that possess much interest in a practical point of view.

Fracture of the Inferior Maxilla, &c.—As an evidence of what extraordinary reparations are made by nature, where there has been apparently hopeless destruction of parts, and as explanatory of the remarkable recuperative powers of the bones especially and adjacent tissues of the lower jaw, we may instance a remarkable case under Dr. J. F. Peebles, of Petersburg, Va., (*Amer. Journ. of the Medical Sciences*, July, 1842.) The patient, an intemperate, middle aged man, attempted to commit suicide by discharging a fowling-piece, loaded with duck-shot, in front and below the angle of the lower jaw on the right side. All the anterior portion of the tongue, together with a complete and remarkably smooth *exsection* of more than an inch of the jaw and two molar teeth, were carried away, with a portion of the cheek and antrum, and finally the anterior portion of the jaw left loose and floating by a fracture at the symphysis. Notwithstanding which, this fragment itself, the only source of annoyance, finally united to its corresponding place at the symphysis, while the cavity, interspace, or vacuity left on the jaw itself, also ultimately became consolidated. No other inconveniences remained but in the loss of motion in the muscles of the lower part of the face, and in the remains of the tongue, reduced now to a mere membrane, which lies on the floor of the mouth. Dr. Peebles supposes, therefore, that a lower branch of the *portio dura* and the motor branch of the fifth pair were complicated in the lesion. A sensation of numbness on the right portion of the lower lip, conveying the feeling as if there was a notch in the glass when he drank, had now, since the consolidation at the symphysis, entirely gone, and the natural feeling been restored; which shows, as Dr. Peebles suggests, that it was the floating fragment which had doubtless temporarily paralyzed the parts by pressure upon the third branch of the fifth pair, as it emerges from the mental foramen.

In addition to the above, M. Newcourt also (vid. *Journal de Chirurgie*, Paris, Oct., Nov., et Dec., 1844, and *Gaz. Méd. de Paris*, Mars 8, 1845, p. 153) has furnished some new observations on these fractures, especially those situated at the incisors or between them, and the cuspidatus, which, if ascertained by future examination to be well-founded, will show that an important pathological fact, in respect to such injuries, has been entirely overlooked up to the present time, and that this ignorance has led to a very improper course of treatment.

M. Newcourt asserts that when in such lesions the jaws are

brought together, or their angles depressed by the hands, the fragments are thereby displaced and more or less separated; but, on the contrary, when the whole jaw is slightly depressed, the parts are brought into exact and close coaptation. He does not pretend to account for this curious fact physiologically, as perhaps it will be found possible to do hereafter, by studying more minutely (as surgeons are now doing from the importance and spread of tenotomy and myotomy) than heretofore, the action of the masseter, temporal and other muscles of the face, and the resulting action of their diagonal and compound forces; but deduces a most important principle in the treatment, by proposing to discard the ancient and long-used head bandage called the *chevestre*, (see bandages, Vol. I. of this work) which has the effect precisely to produce and favor the injurious separation mentioned. M. Newcourt also advises in such fractures, where the teeth can be used, as it were, for splints, to apply the threads so as to include two on each side of the fracture at about half way up from the gum to the crown of the tooth; otherwise, if the two only adjoining the fracture are tied, as is sometimes improperly done, they are not sufficiently firm, for being often more or less loosened by the fracture of the bone, the tendency constantly would be to favor their extraction.

Fracture of the Clavicle.—Mr. Prior, whose judicious conservative practice in compound dislocations, fractures, &c., we have had occasion to speak of, (*supra*.) after discussing the merits of the stellate, or figure of 8 roller, the stuffed leather bandage of the shops, and others in common use for *fractured clavicle*, and which often aggravate the very difficulty we are chiefly called upon to overcome, that of the riding up of the scapular fragment, decides unequivocally in favor of the *clavicle apparatus of Amesbury*, with some modifications, and which is sold by the celebrated Weiss of London. Mr. Prior used this recently with eminent advantage, (*London Lancet*, May 31, 1845, p. 608, et seq.) in the case of a lieutenant colonel of the royal marines, whose collar bone was fractured by his horse falling under him. In a little over a month the union was so perfect that not the slightest trace of irregularity on the surface was perceptible, though the patient had passed the meridian of life.

Fractures of the Wrist.—*Radius.*—M. Sédillot, in a *Résumé Général de la Clinique Chirurgicale de la Faculté de Médecine de Strasbourg*, (*Gaz. Méd. de Montpellier*, Juillet, Août, Sept., et Oct., 1842; *Journ. des Connaiss.*, &c., de Paris, Dec. 1842, p. 243,) gives four cases of fractures of the wrist, from which he feels justified in expressing his full adhesion to the views on that subject emitted by our author, M. Velpeau. The surgeon of Strasbourg thus concludes, by remarking that in most cases the displacements caused by fracture of the inferior extremity of the radius are scarcely perceptible, and that rest, immobility, and resolvents during the first days, and afterwards the starched bandage, gently (*lâchement*) embracing the fore-arm, the wrist and palm of the hand, but sufficiently thick (*épais*) and resistant to ensure the immobility and pro-

per direction of those parts, constitute the easiest, and at the same time most certain, treatment for effecting consolidation, preventing engorgement of the wrist, and promoting a prompt restoration of the motions of the part.

Luxation of the Thumb, with Wound.—M. Demoor (*Journ. de Méd., de Chirurg., et de Pharmacie de Bruxelles*, Juillet, Août, et Dec., 1844; also *Gaz. Méd. de Paris*, Dec. 28, 1844, p. 837) describes the case of a man aged 40, who, in falling, dislocated the second phalanx of the left thumb backwards over the first, causing a wound which laid open the articulation and the long flexor of the thumb. Splints of pasteboard and bandaging seem to have been too severe to the reduced luxation and to the wound, and the whole arm, with the axillary glands, became inflamed, causing intense pain. Amputation was proposed by the surgeon, (which M. Guérin, the editor of the *Gazette Médicale*, approves,) and refused by the patient. Loose bandaging, and keeping the parts wet with tincture of arnica, and administering the same internally to considerable extent were then had recourse to. To this last remedy he chiefly imputes the cure, and extols its virtues as marvellous in external wounds from violence. Roche, Sanson, and Cramer (*Ib.*, *Gaz. Méd.*, *loc. cit.*) cite cases where death has followed such lesions. The virtues of the arnica were lauded two centuries ago, when it was called, on that account by a Dr. Fehr, *panacea lapsorum*, (*ib.*)

Fractures of the Neck of the Thigh Bone.—Dr. Houston, of Dublin, in a lecture on the *Modern Improvements in Surgery*, (*vid. London Lancet*, Dec. 28th, 1844, p. 397,) is, as it appears, a little too unsparing in his reprobation of the ideas of such men as Sir A. Cooper and others of our immediate predecessors on the difficulty of the diagnosis, and the impracticability of the reunion of the fragments of bone in those cases of fracture of the *neck of the femur* frequently met with in old people. Dr. Houston boldly states that the reunions of this bone are found to be not only possible but *common*. To which he adds, in a line equally emphatic: We know, too, *at sight*, what cases *admit of union*, with tolerable certainty, from those in which the chances for such a happy result are few; and still further, what is of equal consequence, we have learned the important fact which all should know, that one of the conditions of this practice, on which depends mainly the chance of reparation, viz., a certain remaining degree of coaptation, and the *presence of certain unbroken shreds* of the softer tissues, is such as to forbid a practice *justifiable*, or even *necessary for diagnosis*, in other fractures, namely, that of seeking for what is termed *crepitus*, inasmuch as the act of doing so may displace the fragments, and tear asunder the only remaining elements of future union, thereby taking away all chance of reparation. Want of due attention to this point, he adds, may have been one of the causes of such infrequency of union in former times. To Professor Colles, deceased, and Drs. Adam and Smith, all of Dublin, he considers the profession chiefly indebted for a knowledge of these important facts.

If the *crepitus*, however—almost the only means of diagnosis here and elsewhere—were thus meant by the illustrious Colles to be *tabooed*, and banished from surgery, it is more, says Dr. Mott, than our personal communication and correspondence with him, and our study and admiration of his invaluable writings, have ever led us to believe; at least, the announcement of such a law would be a death-blow to many of the *bone-setting* empirics of our country who are amassing fortunes, and the reputation of marvellous cures by the most violent and excruciating mechanical torsions and tractions which they are practising and inflicting everywhere, upon the subjects of those ancient dislocations and fractures, not only of the neck of the femur, but of every other bone or joint in the body.

The *modern* discoveries, also, in anaplasty, and in what we have called myo-tenotomy, of the extraordinary powers of nature in the reparation and reproduction of fibrinous and fibro-tendinous and osseous, as well as of cellular and cellulo-fibrinous tissue, where there has been great destruction or alteration of such parts from deformities, wounds, burns, &c., (see Vol. I. of this work,) prove incontestibly that the surgeon has not to apprehend that there will be any *peculiar inability* on the part of nature to make such plastic restorations also *at the neck of the femur*, where certain shreds of capsules, ligaments, or muscular fibres, may have been torn or ruptured, (*dissecta membra*,) as well as elsewhere; but the fact is, that in old persons, being those too in whom the *incurable cases* of such fractures mostly occur, nature has in great measure ceased to perform such *extra work* of nutrition; or on the contrary, is rather occupied in replacing all the molecular substance of the tissues with phosphate of lime and other earthy depositions, in lieu of fibrine, gelatine, &c. T.]

[DR. J. R. BARTON, OF PHILADELPHIA, ON DISLOCATIONS OF THE LOWER EXTREMITIES OF THE RADIUS AND ULNA.—*Views and Treatment of an Important Injury of the Wrist*.—Amer. Jour. of the Med. Sciences, Phila., Vol. XXVI., Philadelphia, 1839, p. 249, 250, 251, 252, 253; as taken from the Philadelphia Medical Examiner.

Any further observations, on a class of accidents, so common, and which have been so often the subject of inquiry, as that of injuries of the fore-arm and wrist-joints, may be deemed superfluous by those who read, but have no personal experience in surgery. But to those engaged in the active pursuits of our profession, it is well known, that notwithstanding the volumes that have been written on this subject, there are yet certain injuries involving these parts, which are not fully understood, and consequently not successfully treated.

My attention was early fixed upon such cases, and through a series of years they have been particularly interesting to me; and it is from my conviction that, up to this time, error prevails, both as

to the nature and the treatment of them, that I am induced to publish my views and practice therein.

I do not know any subject on which I have been more frequently consulted, than on deformities, rigid joints, inflexible fingers, loss of the pronating and supinating motions, and on neuralgic complaints resulting from injuries of the wrist, and of the carpal extremity of the fore-arm—one or more of these evils having been left, not merely as a temporary inconvenience, but as a permanent consequence.

The accidents which are to be the principal subject of my remarks, usually pass either for sprains or dislocations of the wrist. Under one of these denominations are these cases to be detected, which, though partaking somewhat of the character of sprains or dislocations, are distinguishable from either of them respectively. They may be recognised by their being accompanied by more distortion of the hand and arm, than any which can arise from simple sprains of the wrist, and yet less than that which must necessarily take place when there exists a complete luxation of the carpus. The profile of the limb under this injury is a peculiar one, distinguishing it on the one hand from the sprained wrist, and on the other from luxation.

A nice discrimination between these and the other varieties of accidents is not a mere matter of useless refinement in diagnosis; but it is one of great practical importance; as is confirmed by the number of persons who have never fully recovered from the effects of accidents of this nature, treated without such discrimination.

In simple sprains of the wrist, though accompanied by extreme swelling, the limb will still be found to retain a characteristic outline of its natural contour. It is not marked by any abrupt and solid eminences; the swelling is rather uniform, diffuse, and puffy; the hand continues on the same line with that of the fore-arm, &c. In complete dislocations, the nature of the injury must always be very palpable from the great bulging of the overlapped bones, and from the shortening of the limb, &c. Between these two injuries there is too great a dissimilarity to admit of an excuse for the surgeon who mistakes the one for the other; but he may confound with these, and it is a common fault to do so, *a subluxation of the wrist, consequent to fracture through the articular surface of the carpal extremity of the radius*; although to this accident belong appearances exclusively its own.

It is to this peculiar injury that I wish to draw attention.

It is one of the most common injuries to which the upper extremities are subjected; and every practitioner of moderate experience will, I am sure, be able to call to his recollection the appearance which the limb presents under such circumstances, as well as the embarrassment which he has experienced in his attempts to obviate eventual deformity, to preserve the functions of the fingers, and to restore the motions of the wrist and fore-arm.

The similarity of manner in which this accident generally occurs,

is striking. It is almost always found to have taken place in consequence of the individual having thrown out his hand to rescue himself from falling, or to ward off injuries threatening a more important part of the body. In the act of falling, for example, the hand is thus instinctively thrown out, and the force of the fall is first met by the palm of the hand, which is violently bent backward, until the bones of the wrist are driven against the dorsal edge of the articulating surface of the radius, which, being unable to resist, gives way. A fragment is thus broken off from the margin of the articular surface of this bone, and is carried up, before the carpal bones, and rested upon the dorsal side of the radius; they having been forced from their position, either by the violence, or by the contraction of the muscles alone. We have then an imperfect luxation of the wrist, depending on a fracture through the extremity of the radius. The deformity will be found to correspond with this state of the case. There is a tumor on the dorsal side of the arm, formed by the bulging of the carpal bones and fragments; whilst below it, on the palmar side, the extremity of the radius projects. The degree of prominence of these parts, depends upon the size of the fragment, and the violence of the injuring force. The ulna not being very intimately involved in the injury, retains its position, and serves as an abutment, against which the hand seems to rest; whilst the radius, as it has its edge broken off, allows the hand on that side to be drawn upward, and hence to render, on the under side, the styloid process of the ulna more conspicuous than natural. Crepitus cannot always be felt, sometimes in consequence of the smallness or crushed condition of the fragment; at other times, owing to the great swelling and tension; but in every such case, the distortions of the limb are to be seen, and may be removed, by making firm extension and counter extension from the hand and elbow, at the same time gently depressing the tumors already spoken of. By the employment of these means, all deformity, except that which evidently depends upon the more general swelling, may be satisfactorily removed; but the moment the extension and counter-extension are relaxed, the combined action of the flexors and extensors of the fingers, as well as those of the wrist, force the deformity to re-appear as conspicuously as before, and as often as the effort is renewed and discontinued, will the deformity appear and disappear. In this respect does this species of injury in an especial manner differ from a complete simple luxation of the wrist; which, when once reduced, must continue so after the reducing force has been withdrawn. There is no spontaneous relaxation after the simple complete dislocation has been removed; whereas, in this case, it immediately succeeds the withdrawal of the force. This accident must not be confounded with those which are also of frequent occurrence, namely, fracture of the radius, or of the radius and ulna just above, and not involving the joint. It will be found, on referring to the writings of Boyer, Desault, Sir Astley Cooper, Dupuytren, and many others, that this frequently happens, and that the fracture

often reaches to within a few lines of the extremity of the bone; and that these cases are very frequently mistaken for dislocations, though they are in reality fractures exterior to, and disconnected with the joint; the deceptive deformity being occasioned by the displacement of the broken ends of the bone, caused by the action of the muscles and the weight of the hand. A very good illustration of such cases may be found in plate 12, figure 1, in Mr. Hind's folio work on fractures of the extremities. It may there be seen how powerfully the flexors and extensors act in retracting the inferior portions of the bones, and how closely the radius and ulna are drawn together, through the instrumentality of the pronator quadratus muscle below, whilst toward the brachii the pronator teres is exerting its power to keep the limb in a state of pronation. Now these are consequences which do not result from the species of injury to which I refer. The fragment may be, and usually is, quite small, and is broken from the end of the radius, on the dorsal side, and through the cartilaginous face of it, and necessarily into the joint. The pronator quadratus is not involved in the fracture. The radius and ulna are not materially disturbed in their relations to each other. The only important change, which takes place in consequence of this fracture is, that the concave surface at the extremity of the radius, which receives and articulates with the three first carpal bones, is converted, as it were, into an oblique surface by the loss of a portion of its marginal ridge; commonly by the separation of an entire piece; sometimes by the crushing of its substance. The moment the cartilaginous extremity of the radius is deprived of its concave form, the united force of the carpal and digital flexors and extensors is exerted to create a complete luxation; but as the ligaments are only stretched, or but partially torn, this cannot take place. The carpal bones, therefore, only emerge collectively from their natural position, and carrying before them the broken piece, rest on the dorsal side of the radius, forming a tumor there; whilst the end of the radius itself occasions on the palmar side a prominence which is round and smooth, and differing in this from similar projections formed by the fractured ends of bones, the abruptness and harshness of which may sometimes be distinctly felt through the soft parts, and which are themselves, when pressed upon, acutely painful.

It follows, of course, in injuries of this kind, that unless some method of dressing be adopted, whereby the retraction of the hand may be permanently counteracted, and the prominences repressed, the patient will recover with a crooked arm, and under a sacrifice of some of the functions of the hand. The customary modes of treating either sprains or dislocations of the wrist, or fracture of the fore-arm, are totally inadequate to the purpose, and should not be relied on as a treatment for these particular cases by any practitioner who has regard for the welfare of his patient, and for his own reputation. There is no professional point upon which I can more confidently express myself, than upon the errors committed in the treatment of these cases—passing, as they commonly do, for

sprains of the wrist, and hence treated as such. After an unvarying success in the management of this accident for many years in the Pennsylvania Hospital, in the Blockley Hospital, and in private practice, I can strongly recommend the following plan of treatment: Two thin, but firm, splints of wood, are to be prepared, of sufficient length to extend from just below the condyles of the os humeri to the ends of the fingers, and of width enough to embrace the sides of the limb. These are to be lined on one of the sides with carded cotton, or something equally soft, and wrapped with a bandage. Two compresses, each about two inches square, and composed of strips of bandage about one yard and a half long, evenly folded up, are also to be in readiness. The arm is then to be flexed at the elbow, and one assistant is to hold it firmly above the condyles, whilst another makes extension from the fingers. The surgeon now presses the prominent end of the radius on the inner side, and the bulging carpus and fragment on the outer side, into their respective places. The roller is then to be lightly pressed around the hand and arm, securing in its course up the limb, one of the compresses precisely over the carpus and back of the hand, and the other with equal precision over the palmar side of the radius, just above its carpal extremity. These compresses, when properly arranged, will be found, *not opposite to each other, but the inner one commencing on a line opposite to that on which the outer one has terminated.* These being applied, the inner splint is next placed against the limb—the assistant shifting his hand to admit of this being done, without his relaxing in the least degree the extension until the limb is bandaged to this splint, when it will be found that the extension is well maintained. The outer splint is now to be applied and secured to the arm by the return of the roller. The principal use of the latter splint is to act upon the outer compress, and by its general pressure to weaken for the time the force of the resisting muscles. By the employment of these simple means, the indications in the treatment of this accident, will be found to be fully met. The arm may be carried in a sling, and the patient permitted to walk about, &c. In three or four days the limb should be undressed and inspected; and whilst held so that relaxation cannot take place, the wrist and fingers are to be bent enough to preserve the flexibility of the joints. The dressings are then to be re-applied. These operations are thenceforward, for four or five weeks, to be repeated every day, adding to them the motions of pronation and supination.

The practice of keeping a limb in splints, with the joints in an immovable state for weeks, even when the fracture is remote from the articulation, cannot be too earnestly deprecated; and in cases where the injury to be repaired has involved a joint, such treatment is censurable to a high degree, as it is almost certain to destroy the mobility of it by promoting the adhesion of ligaments, the union of tendons with their thecæ, and by obliterating bursæ—evils never to be fully repaired. So prevalent is the error on this point, and so serious are the results of such practice, that I have

settled my mind to the belief, that in very many cases of fractures, the imperfect recovery of the patient is owing to the injudicious use of splints and bandages, rather than to the complication or original difficulty of the case. For the interruption of adhesions of the ligaments, for insuring a continuance of the muscular power and offices of the tendons, and for the entire preservation of the motions of joints, it is indispensably necessary that these parts should be put into action frequently during the treatment of a fracture in which they are interested, either from the adjacency of the fracture, or from their confinement by the splints necessarily used on the occasion. The movement of these parts by the surgeon at stated periods, is not at all incompatible with the quietude and the progressive reunion of the bone itself. The omission of this duty arises, I am persuaded, out of our knowledge of the necessity of securing rest to a broken bone, without at the same time considering that by the means we employ, and the course we pursue to accomplish it, we may entail upon our patient a calamity quite as deplorable as that of an ununited fracture or a crooked bone—namely, a stiff and useless limb. The surgeon, then, is to recollect, that in the cases made herein the special subject of notice, he has not only the duty to perform of obviating deformity of the limb, but of preserving the free motions of all the other parts, and that this can be accomplished only by daily trials of their freedom and functions. [We accord with these sound views; yet how hostile to the system of *bandages inamovibles*! See our notes *supra*, *passim*, Vol. I., and this Vol. II. T.]

By an adherence to the plan of treatment just recommended, and by an attentive pursuance of the means spoken of to preserve the functions of the limb, I have uniformly succeeded in restoring the arm perfectly to its natural shape and offices. I can, consequently, on just grounds, advise others to adopt the same practice.

It sometimes happens, also, though rarely, that fracture of a similar character to the one just described, occurs *on the palmar side* of the radius, from the application of force against the back of the hand, while it is bent forward to its ultimate degree. This usually happens in awkward attempts to parry the blow of a fist, from pressure in dense crowds, and from falling on the back of the hand whilst it is bent forward. Whenever the fracture takes place in front, the end of the radius projects over the wrist on the dorsal side, and the carpal bones and fragment rise out of their proper situations, and form the tumor on the palmar side, thus reversing the deformity of the arm. The principle in the treatment of this variety of the injury, is the same as in the foregoing.

Dupuytren used to trace an analogy between the ordinary fracture of the lower end of the radius, and fracture of the lower end of the fibula; and as he had founded a very successful method of treating the latter injury from the view he took of such cases, he extended his analogy to the treatment of the former, by means and apparatus designed to accomplish the same ends. How far the practice may be successful, when applied to the cases for which

the practice was specially intended, I cannot say. Having myself found simpler means attended with success, I never adopted this practice; but for the treatment of fracture through the joint, &c., the practice would be unavailing. Neither is there any resemblance of this injury to the fracture of the fibula. It may be, however, not inaptly compared to the partial luxation of the foot, depending on fracture of the internal malleolar process of the tibia, including a portion of the articular face of the bone—an accident well known to surgeons.

COMPOUND FRACTURE OF THE OS FEMORIS, by Valentine Mott, M.D., &c. (See *Medical & Surgical Register, consisting chiefly of cases in the New-York Hospital*. New-York, 1818, Vol. I., Part I., p. 65—74.)

This is the third case of compound fracture of the thigh bone, which we have had an opportunity of seeing; and as the two first ended fatally in a very short time, we thought a report of the following case, which eventuated in recovery, with the steps of the treatment, might be favorably received by our readers. Compound fractures of this bone will always have a peculiar danger to accompany them, from the great laceration of soft parts, which is necessary to make this kind of case. In both the cases before referred to, death was occasioned by a remarkable degree of nervous irritation, although the patients were not advanced in life, or by any means of slender and irritable habits. In one of them the femoral artery was found lacerated, and the thigh extensively injected with blood, which, added to the hot season at which it occurred, gave little chance for a favorable issue. The man died within the week after the accident, and before sphacelation had taken place upon the foot. In consequence of the enormous distension of the thigh from blood, this change in the limb would have speedily succeeded, from the want of circulation through the inosculating channels.

In the other case, death took place before inflammation rose to any considerable height. Indeed, both of these patients appeared to lose their lives, more from the irritation of the whole system, than any particular excitement either in the part or in the blood vessels generally. Their limbs were placed in the half bent position, as recommended by Pott, and practised generally by English surgeons.

In the present case, the straight or extended plan was adopted, occasionally making extension with the excellent splint of Baron Boyer, with the addition of the leather foot-piece or gaiter, which we have introduced, and would recommend as by far the easiest plan of making the extension.

The case, as reported by the house-surgeon, is as follows:—

Case of William Moody.—William Moody, a seaman, 35 years of age, born in Salem, state of Massachusetts, was admitted into the New-York hospital, on the 21st of April, 1818, for a fracture of his thigh.

The accident happened on the 14th of the same month, at sea,.

in the ship *Belle Sauvage*, while on her way from Boston to New-York. During a heavy gale, the vessel "shipp'd a sea," and the unfortunate sufferer was thrown from the quarter deck to the waist, against, and partly through, the bulwark. The booby hatch was at the same time carried with him, and as the vessel recovered herself, it fell immediately across his thigh, and fractured it.

The fracture was at first of the simple kind, and the soft parts were not materially injured. The circumstance which renders the case interesting, was the result of a second accident. His shipmates had carried him to his birth, and sat him up on the side of it, and in their hasty endeavors to get him in, his leg fell, and the upper shaft of the bone was made to protrude through the integuments.

Nothing further was done, until the gale, which continued several hours, had subsided, and fortunate it had been for the patient had his officious shipmates suffered him to remain as in their hurry they had left him: but anxious to do every thing in their power to assist him, and ignorant of what ought to have been done, their ill-directed efforts proved highly injurious.

They first bound the thigh with a roller, passed twelve times around it, drawn very tight, immediately over the fractured part; upon this were placed pieces of hoop about five inches in length; these were secured by a small cord drawn as tight as the strength of two men could conveniently make it.

The patient lay with his thigh thus confined for thirty-six hours. The pain, when this dressing was first applied, was severe, but he bore it with fortitude, believing, with his shipmates, that it was absolutely necessary. At length, however, the swelling and inflammation occasioned by the dressing rendered the pain insupportable—he became delirious, and in that state unconsciously removed them. They were not re-applied until two days afterwards. Strips of thick leather were then substituted for the hoops formerly used, and the cord was not drawn as tight as before. In this state he remained until brought into the hospital.

April 21st.—The whole limb was at this time, as might be expected, swelled enormously; its size was nearly twice that of its fellow. The upper portion was in a state of the most active inflammation, the lower œdematous.

The external opening was situated a little below the middle of the thigh, at the upper edge of the sartorius muscle, and was just large enough to admit the finger. The limb was about two inches shorter than the other, and exceedingly painful upon the least motion. The bone was found simply fractured two or three inches below the great trochanter.

It was placed as nearly in its natural position as the state in which it was would permit, and means were taken to reduce the local inflammation and general excitement as speedily as possible.

May 4th.—The swelling was somewhat abated, and the inflammation less active, and the patient was comparatively free from pain, and in every respect more comfortable. There was a small discharge of a well-formed pus from the wound.

The thigh had been kept constantly wet with a solution of acetas plumbi in vinegar, spirits, and water. The many tailed bandage was now applied, and continued for three weeks with advantage. It could not, however, be applied tight enough to keep the bones in their proper situation.

May 25th.—It was deemed expedient to make some extension by means of Boyer's splint, with the addition of a leather gaiter, laced in front, and fastened by straps at the bottom to the foot-piece.

June 1st.—The patient complained of an unusual degree of pain in the thigh; and in consequence of this, the splint was removed, and the bandage thrown off. Upon examination, the thigh was found considerably enlarged, and much inflamed—it seemed probable that an abscess was forming in the outer side, and most prominent part of the thigh. In a few days it became evident, and was opened; it discharged about half-a-pint of well-formed pus.

The abscess proved to be very large. It extended downward, within two inches of the knee-joint, and doubtless commenced with the wound made by the fractured bone.

The relief afforded was great and immediate, but of short duration. In about a week, the lower part of the thigh and knee swelled, and became exceedingly painful. There was evidently matter within, but there was no soft or prominent point offering itself—an incision, however, was made. The discharge was small in quantity, and did not afford the expected relief: the swelling still increased, and the pain became almost insupportable. In a short time, a fluctuating point was perceived about the same distance above the knee, on the inner side of the thigh; an incision was made into it, and on the 12th June, in the course of 12 hours, there was more than a pint of matter discharged, and it continued to discharge about the same quantity daily.

The inflammation and pain now began to abate, and the thigh to assume a more favorable appearance; but the discharge from the four openings was immense. No bandage had been applied to the thigh since the splint was removed. The leg was occasionally confined in a piece of strong muslin laced in front, extending from the foot to the knee, and removed when painful.

June 18th.—A bandage similar to the last mentioned, was applied extending from the ankle to the groin, having holes made in it, corresponding to the openings in the thigh.

July 12th.—Boyer's splint was again used.—The outer opening still continued to discharge a large quantity of matter. As much extension was made on the limb as the patient could conveniently bear; but it proved insufficient to reduce the ends of the fractured bone.

July 29th.—The lower shaft of the bone which projected backward, and could easily be felt through the integuments, produced an ulceration in them, and an opening into the general cavity: The four other openings ceased to discharge any matter, and soon closed.

The limb continued improving in its appearance, though little benefit was derived from the splint.

August 1st.—It was perceived that the bones had united : there was no discharge of pus, but of a thin watery fluid, of a mild nature, and small in quantity. The splint was still continued as a guard to the limb, the bandage occasionally tightened as the swelling abated.

September 12th.—The splint was removed, and the patient allowed to get up, and with assistance placed in a chair for some minutes.

September 20th.—He now sits up the greater part of the day : narrow splints are placed on the thigh, and secured by a roller, to prevent any accident that might occur, but the bone appears to be firmly united, and he is able to bear considerable weight on the limb. The leg is shortened about four inches.

His knee, though somewhat stiff after getting out of bed, is beginning to allow of considerable flexion.

During the profuse discharge of matter, his health was supported by the most tonic medicines and nutritious diet.

To a constitution almost unsubduable, is our patient greatly indebted for his recovery. When the first tumefaction from inflammation subsided, the bone was also found fractured about three inches below the great trochanter, which greatly added to the danger and interest of the case. When the suppuration came on, it extended from the compoundly fractured part of the bone, to the simple one above, and in fact throughout the whole thigh ; inasmuch that fluctuation could be plainly felt from the anterior superior spinous process of the ilium, along the whole course of the crural arch, and extending to the knee-joint.

A little extension was made after the first tumefaction from inflammation went off, but it was at no time considerable. The principal object of the long splint was to give support and steadiness to the limb, and occasionally, as the state of it would permit, to apply a little extension. For some weeks, however, in consequence of the several openings which were made to evacuate the matter it was from necessity laid aside. The foot was now supported in a perpendicular position by a contrivance in the foot-board of the bed. During this time, the whole limb was equally and firmly supported by a firm piece of strong linen or muslin, laced in front, and extending from the groin to the ankle—having openings to correspond with those in the thigh. This form of bandage is the excellent invention of the House Surgeon.

NEW AND HITHERTO UNDESCRIBED FORM OF CONGENITAL LUXATION OF THE HEAD OF BOTH FEMURS.—First described by Jno. M. Carnochan, M. D., of New York.—(First published and delineated by him in the *London Lancet*, 1844, No. 27, Vol. I., p. 781—785.)

We have the pleasure of inserting here a *corrected copy* of the

above remarkable form of dislocation, as communicated to us by the author; who informs us that he will shortly publish another paper on the *pathology* of this disease, his views upon which subject were after the first publication fully confirmed by several dissections of similar cases which he made during his late residence at Paris, the plates of which, and which he caused to be drawn after those dissections, are of extreme beauty, as conveying an exact idea of the condition of the parts. Dr. Carnochan has preserved also a wet specimen of one of these dissections. T.] Dr. Carnochan discourses as follows:—

The affection of which I propose at present to speak, I consider to consist in a transposition of the head of the femur from the cotyloid cavity upon the external iliac fossa of the os innominatum, occurring during intra-uterine existence, generally not so fully manifested in the early period of childhood as it becomes in adult age, when some of the symptoms attendant upon it are peculiar, and the displacement greater and more marked than in the usual luxation of this character resulting from external injury.

Some weeks ago my attention was attracted by a lad who, in his locomotive actions, presented the curious and hobbling motion peculiar to that affection which has been termed congenital luxation of the head of the femur upon the dorsum ilii. As he walked close by me I put several questions to him, and his answers induced me to believe that the impediment under which he was laboring resulted from the abnormal relation of the parts about the coxo-femoral articulation, to which I have just alluded. Having met with examples of this luxation on the continent, I had spoken of it to several of the eminent surgeons of this metropolis, but none of them had the recollection of having seen a case of the kind, and as my own attention had been but lately drawn to the subject, I procured the young man's address (being at the moment under an engagement) in order that an examination of the hip-joints might be made at a future period. Upon my return to London, a few days ago, at my request, my friend, Mr. Clark, of the British navy, accompanied me, with the view of ascertaining the nature of the affection, and as upon examination every appearance and account given went to show that the displacement was owing to an unusual luxation of the heads of both femurs upon the iliac bones, I have deemed the case somewhat worthy of attention, and have drawn up the following statement of it, to which, as illustrative of the position of the parts presented externally, the annexed drawings are added.

Benjamin Gott, the subject of this article, is now nineteen years of age, a shoemaker by trade, of good temperament, and has always been in the enjoyment of perfect health, with the exception of slight indisposition at times. From his earliest recollection, as well as that of those persons who have brought him up, he has labored under an impediment in his walking, but has never met with any accident which confined him to his bed, or to which his present condition could be attributed. There is no abscess nor fistula

around either hip-joint, nor is there any mark or cicatrix to be seen in the ilio-femoral region to induce the belief that those conditions which frequently attend or accompany the spontaneous luxation from morbus coxarins have ever existed.

When looked at whilst he is standing in the erect position, a striking want of proportion and harmony between the upper and lower portions of the body is at once observed, the lower appearing relatively shorter than the upper, and the hands, owing to the ascent of the heads of both femurs upon the iliac bones, considerably above the usual situation of the cotyloid cavities, and the consequent falling down or sinking of the pelvis, are seen to descend about five inches below their usual point, the ends of the fingers reaching beyond the superior margin of the patellæ, when the arms rest along the side of the body. The head, neck, trunk, and superior extremities are well developed, but the trunk appears to be somewhat thrown forwards, and the lower or abdominal portion presents a remarkable salient projection, whilst in the lumbar region there is a corresponding hollow or depression. The inferior extremities, which do not deviate much from the normal position, as regards the direction of the knees or toes, appear shorter, and are more attenuated than natural, and towards the junction of the pelvic extremities with the trunk, the thigh bones seem to be separated from each other farther than natural, so that, superiorly, a space between them is left, giving to the perineal region a resemblance in breadth to that of the female. With respect to the position of the knees and toes, this part of my description differs from that given by Dupuytren, who states that the toes were inverted in some of his patients, and that there was, also, a disposition of the knees to approximate. It is probable that this has been more or less the condition of things in the present instance, as the lad states his foot had formerly an inward tendency, and that his limbs within the last few years, have assumed a more natural direction. As regards the position of the sole of the foot, there is also a difference to be observed, for in the erect position the sole rests entirely upon the ground, as will be seen by a reference to the drawing, nor is there any elevation of the heel, which forms a symptom of this form of dislocation when it is the result of external injury. In tracing the femur of one side (both being similarly situated) downwards from its present resting-place, the upper margin of the great trochanter is seen to be nearly on a level with the crest of the ilium, and the shaft to incline slightly downwards, and forwards to the femoro-tibial articulation, which, in every respect, is natural. The pelvis, instead of having the usual oblique position, approaches more to the vertical direction; the sacro-vertebral angle, and upper portion of the sacrum inclining downwards and forwards, while the coccyx and lower pieces of the sacrum are forced upwards and backwards. By tracing the superior margins of the ossa ilii from the posterior superior spinous processes forwards to the anterior superior spinous processes of these bones, the ossa innominata are found to be tilted much more forwards than is observed in the nor-

mal inclination of the pelvis, and the anterior superior spinous processes are depressed downwards and forwards so far that the convexity of the iliac crests present almost an anterior aspect. The symphysis and arch of the pubis are thus thrown downwards, whilst the tuberosities of the ischia are made to ascend slightly upwards and backwards, so that these eminences are nearly on a level with the arch of the pubis, and the rami of the ischia and of the ossa pubis consequently almost horizontal. Although the position of the pelvis is thus out of its usual *inclination*, there is no relative displacement of the individual parts which compose this important part of the skeleton. Thus, the alæ of the iliac bones are not misshapen, and the tuberosities of the ischia are distant from each other four inches, while at the anterior superior spines of the ilia there is a space of nine inches and a quarter. Between the anterior superior iliac spine and the tuberosity of the pubis the measurement is five inches and three-quarters, which is perhaps slightly more than in the generality of young adult males, and the pelvis so far generally well formed, as regards its relative dimensions, is also entirely free from any of the results of rachitis, or any of the other forms of disease to which the osseous tissue is liable.

The most prominent deviation from the normal state of parts which the deformity in question presents is caused by the unnatural position and remarkable projection of the great trochanters. The heads of the femurs, having escaped from the acetabula, have mounted upon the dorsa of the ilia so high as to carry the upper portions of the trochanters nearly on a level with the iliac crests. The heads of the femurs being thus so far removed from the proper situation of the cotyloid cavities, the nearly equilateral triangle which the anterior superior spine of the ilium, the tuberosity of the pubis, and the trochanter major, will form, when the coxo-femoral articulation is undisturbed, is entirely broken up, and a prominence is produced by the projecting trochanters on either side so marked, that even a casual observer could not fail to notice it. In the present case of congenital luxation the heads of the femurs rest, also, higher up, and more posteriorly, than in the common dislocation from external injury, and the normal relative position of the head and trochanter, with the surface of the iliac bone, is maintained, that is, the head of the femur is not thrown backwards and the trochanter forwards, as generally takes place in this form of the traumatic luxation. The head and neck of the bone standing out, as it were, nearly at a right angle from the resting-place on the dorsum of the ilium, gives the trochanters the prominent appearance which they present, and this also will enable us to account for the non-inversion of the toes, and the almost natural direction of the limbs.

Besides the other symptoms, such as shortening of the limbs, the slipping up of the head of the bone on the external iliac fossa, and the unnatural relation of the great trochanter, which this luxation presents in common with the other dislocations in which the head of the femur is carried upwards and outwards, in a similar direc-

tion, the muscles in connection with the joint offer some peculiarities worthy of remark. The spinal muscles, which form the sacro-spinal mass, taking their origin from the sacrum, lumbar vertebræ, and posterior part of the ossa ilia, and running along the vertebral grooves on each side of the spinous processes of the vertebræ, are found to be hard, tense, and prominent, particularly in the lumbar region; the psoæ, and internal iliacs coming from the lower dorsal and lumbar vertebræ and iliac fossæ, to be inserted into the trochanter minor, being retracted by the ascent of the femur and stretched over the brim of the pelvis, now acting like a pulley, are, also, found tense and cord-like, whilst nearly all the muscles of the superior part of the iliac region, the gluteus maximus, medius, and minimus, &c., are retracted towards the crest of the iliac bones,—“où ils forment, autour de la tête du fémur une espèce de cône, dont la base est à l'os iliaque et le sommet au grand trochanter.” (Dupuytren.)

The particulars, so far stated, refer to the subject in the standing attitude, but in the *recumbent* posture, some of the causes of displacement, such as the physiological action of the muscles and the weight of the superior parts of the body ceasing to exist, the signs of this affection become evidently less marked, and in some respects almost effaced, which never is the case in the usual traumatic dislocation. The muscles, now, not being called into action, the hollow in the lumbar region disappears, the abdomen does not present the anomalous projection formerly alluded to, the pelvis seems to acquire a more natural inclination, the head and trochanter descend several inches more towards the usual situation of the cotyloid cavity, and present an elevation neither so prominent, nor so much removed from the normal position they ought to occupy. The measurement from the tuberosity of the pubis to the summit of the great trochanter is seven inches and a quarter, when in the recumbent posture, while it is nine inches and a half when he is standing.

In *walking*, the heads of both femurs ascending and descending alternately, upon the dorsa of the iliac bones, and playing, as it were, through a space of nearly three inches, produce the hobbling motion which has been mentioned. Thus, while the body is supported upon the right limb in the act of stepping, the right femur ascends, while the left, being freed from the super-incumbent weight of the trunk and superior extremities descends, to ascend again as soon as the left foot rests upon the ground, and the weight of the body is transferred to it. Contrary to what, at first, might be anticipated, this unsteady gait is less observable in the act of running than in walking, the increased energy of the muscular contraction, and the more rapid movements of the limbs not permitting nor allowing time for the head of the bone to pass through its accustomed range of motion, during the slower mode of progression. Although, as has just now been said, the alternating movements of the body are not so marked in the quicker motion of running as in walking, yet owing to the more or less friction of the displaced

head of the femur upon the iliac fossa, the altered and unfavorable position in which the muscles have now to act, and the irregular and fatiguing swinging of the body from one side to the other, this individual is unable to take exercise in the erect posture, without soon evincing signs of discomfort, and complaining of considerable pain, more particularly in the groins and lumbar regions.

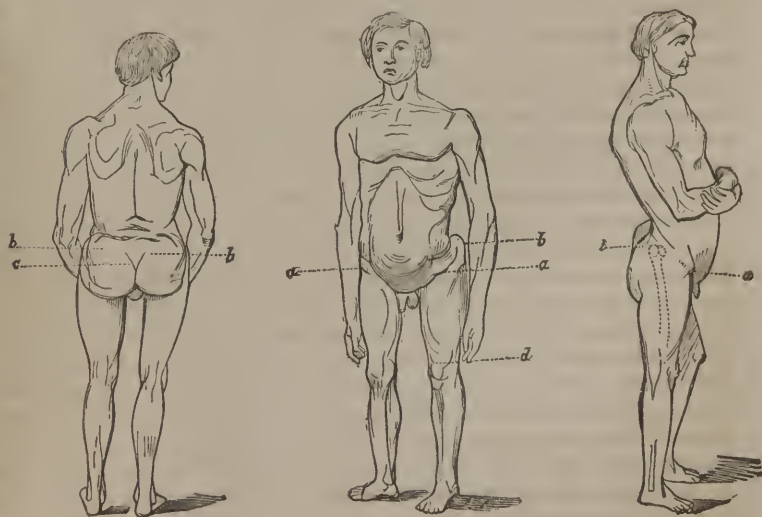
By grasping the thigh, and moving the limb after the pelvis is fixed, a sensation of crepitus, resembling that given by joints which have suffered from rheumatic inflammation, or effusion into their cavities, is distinctly perceived. From the present abnormal position of the parts around, and in connection with the ilio-femoral articulation, as a natural consequence, the various motions of the inferior extremities are considerably interfered with, and limited, but by no means are they so restricted as in the traumatic form of this dislocation. Adduction of the extremity is not much interfered with, and one thigh can be carried over the other with facility, but abduction is performed with difficulty, the thigh having but a few inches of latitude in this direction, and in the endeavor to sit, as in the attitude of riding on horseback, across a high chair, of the common breadth in the seat, it is found that this position cannot be effected, owing to the limited extent of separation allowed to the ossa femoris. While the knee-joint is not bent, the movements anteriorly are considerably impeded, but when the thigh is flexed upon the pelvis, as takes place in the act of stepping upon a foot-stool, or going up a stair-case, little effort is required. The motion of the thigh directly backwards is somewhat confined, but rotation inwards, and particularly outwards, is nearly natural.

In the sitting posture, while the trunk is kept nearly erect, the lumbar vertebræ are not then dragged so much forward, and this appears to be the position least irksome while it can be maintained; but in the stooping attitude, as that of the cobbler at work, which in his trade this youth has to adopt, the lumbar and lower dorsal vertebræ assume a convexity backwards, and the *psosæ* being thus put upon the stretch, great uneasiness is experienced in the loins if this posture be prolonged for any considerable length of time.

These, then, are some of the most marked pathognomonic characters observed in this congenital affection, which, I am inclined to believe, is of much more common occurrence than the slight notice, or rather entire silence observed regarding it by authors in Britain, or my own country, would induce one to suppose. Thus we are told by Dupuytren that he met with twenty-five cases of the "*luxation originelle de la tête du fémur.*" Jules Guérin records that he has seen over thirty cases, and within the last two years, since my attention has been attracted to the subject, although I have been prevented by circumstances from making as many observations on this subject as I might otherwise have done, I have met with four well-marked cases. That these remarks may not rest upon single authority, I will state that one of the cases was seen, at the same time as by myself, by that accomplished physician, Dr. Henry Bennet, now of London, but who, at the time to

which I allude, was delivering a course of private lectures at the Hôpital St. Louis, in which institution he was then acting as "interne." Two of the other patients I saw were under treatment by M. Guérin, at the Hôpital des Enfants Malades, and the fourth is the subject of this article, and is represented by the accompanying sketches.

By a reference to the "Orthomorphie" of Delpech, this subject seems to have first attracted the attention of Palletta, a surgeon of Milan, and since his time, Delpech, Dupuytren, M. Sédillot, and Jules Guérin, have given descriptions so detailed as not to leave any doubt as to the intra-uterine origin of this deformity. But, according to the last-named authority, the original luxation of the head of the femur upwards and outwards, although the form generally met with, is not the only displacement which the coxo-femoral articulation is liable to undergo during fœtal life; three other varieties having been enumerated, and demonstrated by him before the Royal Academy of Medicine, at Paris, viz., a luxation directly upwards, a luxation upwards and forwards, and a sub-luxation upwards and backwards; and if the cause, of which these congenital deformities are the result, be such, in reality, as that to which reference shall presently be made, it only requires the power of generalization, easily to conceive the possibility of the articulating surfaces of any joint of the body, from the glenoid cavity of the temporal bone to the articulations of the tarsus, undergoing unnatural transposition at that period of life when the relative articulating surfaces of the joints are but partially developed, and this



- a.* Anterior superior spinous process of the ilium.
- b.* Trochanter major.
- c.* Os coccygis, tilted upwards.
- d.* Upper margin of the patella.

exciting cause is brought into play by a primary morbid state of some part of the nervous system or centres.

From such confirmation of the existence of such a malady, and from a consideration of the serious evils its continuation will entail upon the sufferers as regards the enjoyments of life, and the performance of its duties, it behoves the accoucheur, as well as the surgeon, to be prepared to form a correct diagnosis in relation to this affection, to prevent erroneous and painful practice being resorted to, and in order that the proper therapeutic means, as far as yet known, or superior judgment might suggest, may be adopted to remedy the deformity before the approach of adult age would proscribe the utility of such an attempt. The subject of the case I have detailed has been sent down to Margate by his medical attendants, for six months at a time, for the benefit of his hip-joints, under the supposition of the affection being of a scrofulous nature; and we find Dupuytren writing as follows in regard to this point:—
“Plusieurs individus, affectés de luxation originelle, ont été contraint, par suite de cette erreur de diagnostique, à garder le lit pendant plusieurs années. J’en ai vu d’autres, qu’on avait forcés à supporter des applications, sans nombre, de sangsues, de vésicatoires, de cautères, et, surtout, de moxas. Je me rappelle, entre autres, une jeune fille qui souffrit l’application de vingt-et-un moxas autour des hanches, sans que ce traitement, inutile ou barbare, eût apporté aucun changement à la situation de cette infortunée.”

So far as, at this moment, strikes us, the congenital luxation of the head of the femur upwards and outwards upon the dorsum of the ilium, can only be confounded with, or mistaken for, that dislocation which takes place in the same direction at the ilio-femoral articulation, as the result of external injury; or, that spontaneous luxation, as it is called, of the femur upon the external iliac fossa, which results as a natural consequence of the absorption and destruction of the head and neck of the bone during the progress of that strumous disease of the hip-joint known generally by the name of *morbus coxarius*. Upon examination, however, each of these affections will be found to possess characteristics sufficiently remarkable to enable us to arrive with reasonable certainty at the differential diagnosis. In the recent dislocation from external injury upon the dorsum ilii, the shortening of the limb, the inversion of the toes, the lessened mobility of the joint, and more flattened appearance of the affected hip, are not difficult of detection. The strumous diathesis of the patient, and the relation of his case by himself or friends, the previous inflammatory condition of the hip-joint, with the accompanying symptoms of fever, pain, &c., the formation of abscess, and the existence of fistulæ in the earlier stages, and in the latter the ulceration and disappearance of the head and neck of the bone, the trochanter alone being left resting upon the iliac fossa, the frequent resulting ankylosis and flat aspect of the hip, are symptoms sufficiently pathognomonic to characterise the condition of things usually attendant upon the various phases of “hip disease.” While, in regard to the congenital transposition of the

head of the femur upon the external iliac fossa, the whole history of the patient, from the earliest period of infancy up to the time that relief or advice is applied for, the lameness shown upon the first attempts to walk, the general good health he has enjoyed, the total absence of primary inflammatory symptoms, or the receipt of any injury, the extraordinary hobbling (clochant) gait during the act of slow progression, the prominent aspect of the abdomen, and the correspondingly hollow appearance of the lumbar region, the existence generally of a double and similar luxation on both sides, the partial or total disappearance of many of the above symptoms in the recumbent position, the unusual projection of the great trochanter, owing to the presence and direction of the head and neck of the femur, which are placed nearly at a right angle, and not in a line with the surface of the iliac bone, as happens in the traumatic luxation; and, above all, the ascent and descent of the head of the femur upon the external iliac fossa, through a space of nearly three inches, the upper margin of the trochanter major becoming nearly horizontal with the crest of the ilium, or appearing several inches below the same point, and according as the limb is pushed upwards or pulled downwards;—these data, taken collectively, and in connection with the entire freedom from all pain during the attempts to move the parts about the seat of the displacement, will form an assemblage of peculiarities so evidently and palpably different from the circumstances accompanying either of the two forms of lesion already referred to, that we are obliged to look upon the morbid condition associated with the group of symptoms last enumerated as belonging to another species of disease, and to classify it as more properly belonging to that genus of affections which, in more modern times, have received the name of congenital luxations.

From some remarks made by one of the authors previously alluded to, it would appear that the congenital luxation of the head of the femur is more or less of an hereditary character, and that females are more subject to it than males. I have not had the means of confirming the former observation, but should be inclined to give credence to it, as experience has corroborated the existence of this family predisposition in the case of club-foot, which affection most probably belongs to the same class of maladies as the congenital deformities of which we have been speaking. In relation to its more frequent occurrence among females, Dupuytren states that out of the twenty-five cases which he had seen, three only were males; of the four cases which have come under my own observation two were males and two females.

The peculiarities and symptoms accompanying congenital luxation of the head of the femur upon the dorsum ilii, being found, upon comparison, to be so different from either of the other forms of disease above alluded to, and with which, from a cursory examination, it might be confounded, we are naturally led from seeing a result or effect so different, to seek also for a difference of antecedence or *cause*. The celebrated surgeon to whom we have

last alluded asks, in relation to the cause of displacement, "Can it be the product of a disease occurring to the fœtus in the womb of the mother, and cured before birth? Can it be the result of an effort, or of violence, which might have caused the head of the femur to escape from the cotyloid cavity; and the cavity itself, might it not become obliterated without disease, and only because from want of action or employ, it would be useless? Can nature have forgotten to mould a cavity for the head of the femurs,—or, rather, can this cavity, which is the result of the concurrence and reunion of the three pieces of which the os innominatum is composed, have remained imperfect on account of some obstacle to the evolution of the bone, as M. Breschet has been induced to suppose?" Each of these causes represented in the foregoing interrogatories might, we can conceive, be supported by arguments more or less favorable, none of them, however, bearing a character so entirely conclusive as to carry implicit conviction, or sufficiently satisfactory as to render further investigation into the origin of these affections apparently unnecessary. If disposed to attribute this transposition of the head of the bone to some violence exerted during the act of parturition, it would be difficult to imagine, even when we consider the different positions which the fœtus may assume in the uterus, by what means the mechanical force could be applied so as to displace the head of the bone in an upward direction, or by what species of manipulation, either instrumental or manual, the accoucheur could so proceed as to produce the transfer of the head of the femur upwards and outwards upon the dorsum ilii; in other words, in a direction exactly contrary to that of the force which may be supposed to be brought into play. Nor would it be more easy to follow the head of the bone, after it had been once dislocated downwards into the foramen ovale by traction, as some have supposed, during a difficult labor with a breech or footling presentation, taking again its upward course over the natural position it ought to occupy at the acetabulum, and refusing to remain quiescent until it has arrived at the external iliac fossa. Something may be said in support of the theory of the *arrêt de développement*, as contributing to the primary displacement of the articulating surfaces, but, in the present case, if we can judge from the projecting trochanters, there is but little alteration as regards the head and neck of the femur, and autopsic examinations which have been made go to prove the filling up and contraction of the acetabulum from its immaturity and consequent inactivity, rather than any imperfection in the ossification of the cotyloid cavity at the junction of the three pieces which unite to form it, and which ought to be the place where the occurrence of any defect, if any existed in the evolution of the osseous tissue, should be observable, according to M. Breschet's theory. The hypothesis of M. Dupuytren, that a primary imperfection of the germ ("des vices de conformation originels, et qui tiennent à un défaut dans l'organisation des germes") must have some relation with the cause of the displacement (and which idea led him to give the name of "original" luxations to this class

of affections,) carries but little probability with it; nor does the position of the thighs, flexed as they are upon the abdomen of the child in utero, and the consequent pressure of the head of the femur against the lower and inferior portion of the ilio-femoral capsule, satisfactorily explain the reason of the ascent of the head of the bone upon the ilium. We can imagine that this position of the head of the femur, and the natural shallow state of the acetabulum during fœtal life may have a predisposing tendency to induce displacement, but we do not believe that mere position without the action of some morbid auxiliary cause, could alone have the effect of bringing about the pathological condition of which we now speak. Although it is well known that the child, while yet in the womb of the mother, is liable to many diseases, yet children who have been born with this altered relation of parts at the ilio-coxal articulation have not shown any particular ill condition of health at birth, sufficient to attract the attention even of medical attendants, and this consideration and the absence of anything like inflammatory engorgement, abscess, fistula, or cicatrix, at the period of birth, must leave little doubt that the displacement cannot have for its origin that strumous affection in utero which, in extra-uterine life, we often remark to be the cause of "spontaneous luxation" of the head of the femur upon the dorsum of the ilium.

The remote cause, then, of the class of congenital deformities, and, amongst them, that of congenital luxation of the head of the femur, we should be inclined, with a French writer, to refer to a morbid condition of the nervous system or centres; and the proximate cause, or that which most obviously produces the displacement of the parts, to the pathological contraction ("*la rétraction musculaire active*") which, acting as the unavoidable result of the primary disease, with more or less activity and diversified combination, ultimately effects the entire dislocation of the articulating surfaces. This connection between a primary disturbance in the nervous system and congenital deformities, as cause and effect, first brought forward by Rudolphi, the celebrated anatomist, has been confirmed by his successor, Müller, and some other modern physiologists. M. Jules Guérin, of Paris, in several memoirs read before the Académie Royale de Médecine, has brought forward much interesting information on this subject, and has shown from repeated dissections that there is a constant relation between this pathological condition of the nervous apparatus and the more or less general retraction manifested in the muscular system. The existence of a state of disease which may have an influence so universally extensive over the whole muscular system, or be limited to a particular portion only of it, has enabled the pathologist to attribute to one common source the origin of numerous maladies which formerly were referred to as many different causes, and from data now known we can thus, by generalisation, simplify and reduce to a unity of origin the whole class of those deformities of the human shape which, as a result of morbid muscular action, take place at

the articulations in the shape of club-foot, distortions of the spine, torticollis, and congenital luxations, &c.,

But congenital luxation of the head of the femur upon the ilium, although caused primarily, as we believe, by this dynamic or morbid retraction of a portion of the muscular apparatus, occurring during intra-uterine life, is also subjected to causes which begin to act only after birth, and which materially modify the appearance and extent of the displacement of the articulating surfaces in relation to the age of the individual affected. Thus, in this luxation, the head of the bone is generally, at first, placed near the confines of the acetabulum, resting upon its margin or a little above it, but as soon as progression begins to be performed, the superincumbent weight of the trunk carries the pelvis downwards, and the heads of the femurs being entirely freed from their natural cavities, and having now no point of resistance superiorly, ascend gradually upon the external iliac fossa, until, at last, as adult age approaches, as in the example before us, the pelvis is wedged down between the upper portions of the ossa femoris, and the superior margins of the great trochanters are found almost on a level with the iliac crests. One of the primary effects of the pathological contraction of the muscles, as evidently seen by the attenuated state of the muscles in the ordinary forms of talipes, is a diminished nutrition, which gives rise to a kind of "*arrêt de développement*" in the parts affected. The osseous structure of the pelvis, however, being in no way under the influence of disease, increases in proportion as extra-uterine life advances, while those muscles originally affected, and which produced the displacement, suffering still from this impediment to their natural development, do not elongate in proportion to the other parts, and thus, also, when the head of the bone has once escaped beyond the limits of the cotyloid cavity, is its tendency to ascend on the external iliac fossa promoted. It is not difficult to understand that the physiological action of the muscles acting in the direction of the displacement, will have a tendency to induce a farther removal of the head of the bone upwards; and that the muscles, towards the internal part of the thighs, such as the adductors, semi-membranosus, semi-tendinosus, &c., having changed their angle of insertion, will, during the progressive movements of the inferior extremities, act upon the ossa femoris so as to throw the head of each upwards and somewhat outwards. These auxiliary causes, viz., the weight of the body, the impeded growth of the muscles affected, and the physiological action of the muscles, taking effect only after extra-uterine life has begun, readily account for the transposition in cases of congenital luxation of the hip-joint as well as in the other affections of this class occurring in a gradual manner, and becoming, in the course of time, more marked, after the various sources of displacement have fully exerted their combined influences.

Having said thus much at present in relation to the symptoms, diagnosis, and cause, of the congenital luxation of the head of the femur upon the dorsum ilii, I shall recur at a future time to the

pathological appearances observed upon post-mortem examination, and the therapeutie means which have been adopted to remedy this deformity or palliate its inconveniences.

Supplemental Note.—Since this paper was written, I have seen, at Paris and in London, at least a *dozen* more cases of this disease; which have still further confirmed the opinions I have advanced in relation to the greater frequency of this luxation than is generally supposed. From these additional observations which I have had an opportunity of making, I am also inclined to corroborate the opinion of Dupuytren regarding its more common occurrence among females.

Although in the case above described, as far as could be ascertained by measurements upon the living subject, the diameters of the pelvis, remained nearly natural, I am perfectly satisfied from dissections I have lately made at Paris, of *three* cases of this luxation, that the diameters of the pelvis both at the superior and at the inferior straits, become materially altered, chiefly as a natural result of the displacement of the heads of the femurs, the change of direction thus given to the action of the muscles, and the consequent influence of muscular action upon the osseous tissue of the basin during early life, before the bones have acquired the final and perfect organization of adult age.

This fact becomes of greater importance, from the ascertained evidence of this disease occurring more frequently in females than in males; and suggests to the accoucheur the necessity of being fully prepared to encounter much difficulty during parturition, where this luxation exists in the female, whether the luxation be single or double, of which I shall speak more in detail in the additional memoir which I contemplate on the *Pathology* of this luxation.

JOHN MURRAY CARNOCHAN, M. D.

New York, Dec., 1845.

DR. MOTT'S CASES OF EXSECTIONS OF THE LOWER AND UPPER JAW, CLAVICLE, &c.

Claims of Dr. Mott as the Author and Projector of the Operation of Exsection of the Lower Jaw.—We cannot permit ourselves to believe that any surgeon of rank, possessing the high moral character which it is presumable should, or we might say must, necessarily belong to at least the distinguished members of the medical profession, as the guarantee of eminence and respectability, would willingly or wilfully deprive another of the honor that belongs to him.

It is therefore through sheer inadvertence or ignorance, which some might call culpable, of the true facts of the case, that must have permitted a surgical gentleman, while giving a public lecture in the capital of Dublin, at a public medical school, and his subject too, *On the Modern Improvements of Surgery*, (See Lecture on that subject by John Houston, M. D., M.R.I.A., introductory to a course of Lectures on Surgery in the School of Medicine, Park street, Dublin, delivered 4th of November, 1844, and published in the *London Lancet* for December 28th, 1844, p. 393, et seq.,) to promulgate, as it were, *ex cathedrâ*, and “by authority,” to the rest of the world, the following sweeping eulogy, without a single word of qualification in behalf of any other individual whatever:—

“The *grand exploit* of amputating the lower jaw, even from its articulations, the boldness of which has been only equalled by its success, has now become a standard operation in surgery. Persons afflicted with the distressing and loathsome disease [showing a drawing of it] for which this operation is undertaken, were formerly allowed to die, without any idea being entertained of the possibility of saving them; but NOW THAT A GREAT MIND, RELYING ON A SOUND KNOWLEDGE OF THE CAPABILITIES OF THE HUMAN FRAME, has set the example of extirpating the diseased mass *in toto*, many surgeons have fearlessly followed in the path thus laid open FOR THEM, and have derived honor from the success which crowned the enterprise. The success of this operation—both as regards immunity from danger, rapidity of convalescence, and the useful quality of masticatory apparatus which follows—is almost incredible.

“Mr. Cusack (*i. e.*, of Dublin) has operated twelve times, and here, showing them) [*i. e.*, the audience] are the preparations, casts and drawings of the whole series. Now, in all these cases there has been but one death, and that not as the result of the operation, but from erysipelas.”

After giving the case of a recent similar operation by Mr. Cusack, as an illustration, Dr. Houston concludes thus:—

“And shall I not call this a *modern* improvement in surgery, when the GREAT AUTHOR and *champion* of it is seated amongst us in this room.” (*Loc. cit.*, p. 394.)

To whomsoever, therefore, the honor of this great triumph be-

longs, *mutatis mutandis*, the eulogium ought to apply equally well in Dr. Houston's conceptions, who, doubtless, would not desire to diminish one iota of it, because a name of different orthography from that of the justly respected Mr. Cusack, should happen to be found by a species of anaplastic substitution, to dove-tail more completely than his with the historic facts in the case.

We say cheerfully with all our heart, *palmam qui meruit ferat!* We will also shut our eyes too against such mis-interpretation as the apparent intentional suppression of all other names connected with this matter than that of Mr. Cusack might naturally suggest, for the author of the lecture is since, we regret to hear, deceased.

No. I., 1821; Nov. 17th and 18th.—CASE OF OSTEO-SARCOMA—in which the right side of the lower jaw was removed successfully after tying the Carotid Artery. By Valentine Mott, M.D., Professor of Surgery in the University of New-York. (See New-York Medical and Physical Journal, Vol. I., No. 4; Oct., Nov., and Dec., 1822, p. 385–394. Four plates.)

Catharine Bucklew, the subject of the following operation, was an interesting young woman, aged about seventeen years, of a healthy appearance and good constitution.

She says that about two years since, a swelling commenced behind the last molar tooth of the lower jaw, attended with acute pain about the angle of the jaw, that continued about three weeks; at which time it left her without any evident resolution of the inflammation. At this period there was no inflammation of the integuments, nor could any pus be discovered either on the cheek or about the bone within the mouth. Some domestic applications were made to the cheek, but the tumefaction continued to increase, and assumed a smooth, hard, and bony character.

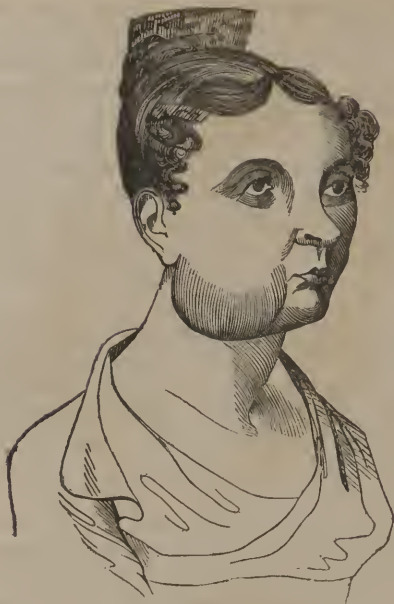
About twelve months after its commencement she applied to a physician in New-Jersey, who advised her to apply blisters to the cheek, and the use of topical applications of caustic to the tumor, together with a general antiphlogistic constitutional treatment. After having submitted to this course for two months without experiencing any benefit, she came to this city, and became my patient.

The first molar tooth came away early in the disease, and the second soon followed; then, three or four of the other teeth of that side of the lower jaw. She states, that previously to this disease she had never had a decayed tooth.

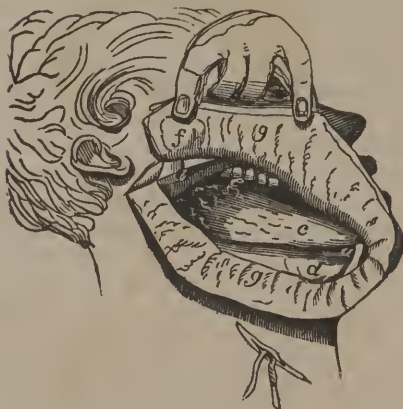
No fluctuation was to be felt at any time in the tumor. She had no constitutional symptoms as the effect of this disease, nor any inordinate headache on that side. The lymphatic glands of the neck were however swollen, during the continuance of the inflammation in the early part of the disease; but they disappeared as soon as the pain subsided.

When she came under my care, the tumor extended from the

(Plate I.)



(Plate 2.)



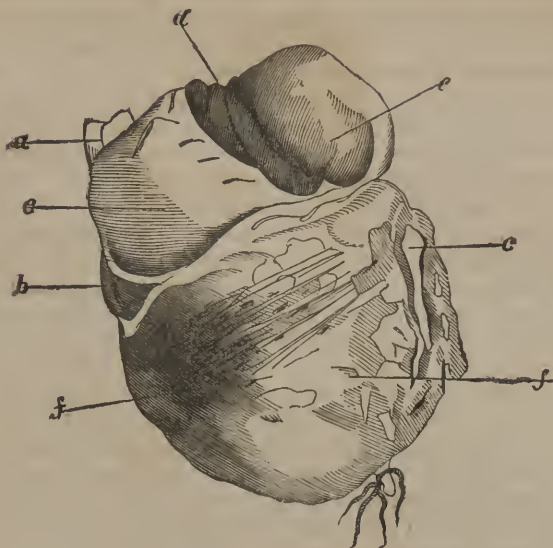
No. I.

This drawing exhibits the appearance of the face before the operation was performed. The rotundity of the right cheek will be observable, and the integuments below the under eye-lid, on the stretch from the size of the osteo-sarcoma.

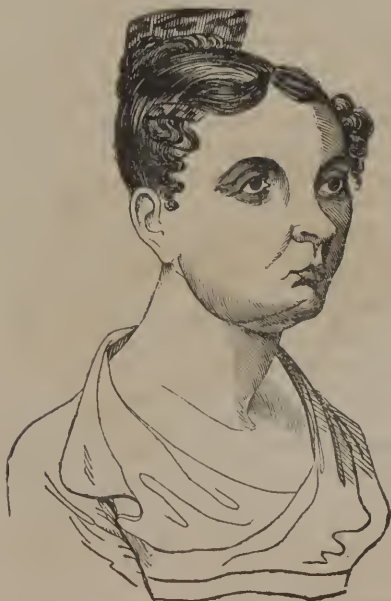
No. II.

Represents the side of the face after the tumour was removed, and before the parts were closed. *a* The part at which the jaw-bone was divided near the chin. *b* Condylloid process, where separated by the saw; the coronoid process being drawn up by the temporal muscle. *c* The side of the tongue. *d* Sub-lingual gland. *e* Molar teeth of the right superior maxilla. *f* Inferior portion of the parotid gland, with a plane of fibres of the masseter muscle turned up. *g g* Portions of the common integuments.

(Plate 3.)



(Plate 4.)



No. III.

This figure exposes the appearance of the tumour up on the inner surface. *a* Cuspidatus and first bicuspid teeth. *b* Lower jaw where divided anteriorly. *c* Bone at its posterior division. *d* Furrow produced by the teeth of the upper jaw. *e e* Two superior portions of the tumour covered by the membrane of the mouth. *f f* The remainder of the inner surface of the tumour, dissected from the parts within the mouth.

No. IV.

The appearance of the patient after her recovery.

root of the coronoid process to the second bicuspid tooth, elevated nearly an inch above the level of the teeth, and spreading considerably wider than the alveolar process. Its appearance was smooth, and to the touch somewhat elastic, though firm. An incision on each side of the alveolar margin, with a scalpel, enabled me pretty readily to remove the tumor with a gum-lancet to the level of the jaw-bone. The tumor, on examination, contained many cartilaginous and osseous spiculæ, and in the substance of it was imbedded one of the molar teeth in a perfectly sound state.

About three weeks after this operation a small portion, of the size of a nutmeg, which had granulated and grown rapidly, was taken off, and soon after she retired to the country, and remained in a very comfortable state for several months. The tumor began now to re-appear, and continued to increase gradually in every direction.

The tumor, at present, (Nov. 10th, 1821,) has the same firm and slightly elastic feel which characterized it in the early stage, involving all the right side of the inferior maxillary bone. Projecting outwards, it produces great convexity of the cheek: upwards it divides into two portions, the outer and longest reaches up to the os malæ, and between the two is a considerable furrow, formed by the teeth of the upper jaw, which occasions an abrasion and constant discharge; the latter, though offensive, does not appear to be acrid or irritating: downwards it comes nearly in contact with the thyroid cartilage; inwards it extends beyond the middle line of the mouth, pushing the tongue and uvula very much to the left side, having the velum pendulum palati of the right side attached to it in its whole course. The inward portion is considerably raised above the level of the tongue when the mouth is opened.

The posterior extremity of the tumor has encroached so much upon the passage leading into the posterior nares, and the pressure of the lower parts upon the larynx is so considerable as to render deglutition very difficult; and from the great difficulty of mastication, she has been compelled for some time to subsist upon liquid aliment. Her speech is considerably interfered with in consequence of the displacement of the tongue. She experiences no pain in any part of the tumor.

The gradual increase of the disease rendering mastication and deglutition more difficult and distressing, she is very desirous of knowing if an operation could not be performed which might extend to her some chance of life; observing, that with the constant growth of the tumor, such as has taken place for a few weeks past, she should not be able to swallow anything in a short time. Fully aware of the dangerous nature of the novel operation her case requires, she is determined to submit to it, and hazard the consequences; the uncertain result of which I carefully explained to her, and informed her, that she might die during the performance of the operation; but that I believed it to be both practicable and proper.

After preparing the system for about a week with light diet, and

the exhibition of several doses of neutral salts, to obviate any great degree of inflammation, the operation was commenced about 11 o'clock on the morning of the 17th.

As most of the important branches of the external carotid artery would be interfered with in the course of this operation, I believed it most prudent to pass a ligature around the primitive trunk as a first and preparatory step. This would not only enable me to go through it with more safety to the patient, but appeared the most important of all means to avoid inflammation. Indeed inflammation was much to be dreaded, from the immense extent of the external incision, and the violence which would necessarily be done to the tongue, palate, and pharynx.

From these considerations, I felt it doubly important to intercept the current of blood through the common carotid, and from what I had observed to attend the application of ligatures to the large arteries of the extremities, in cases of severe injuries, by preventing inflammation, I thought great advantage would attend it in this case, as I am satisfied will be fully shown.

An incision about two inches and a half long was made a little below the thyroid cartilage on the inner edge of the sterno-cleido-mastoideus muscle, and after exposing the carotid, a single ligature was passed under it and tied. It was deemed most proper to tie the carotid, in this situation, in order to prevent the second part of the operation from interfering with the first incision. Very little blood was lost, and only one small cutaneous branch at the lower angle of the wound required a ligature; yet she became pale and almost pulseless during, and immediately after, the operation, notwithstanding her position was recumbent. She submitted to the operation with great firmness and resolution, but her mind soon became agitated and perturbed to a great degree, and it seemed altogether impossible for her to regain her former fortitude. The operation was suspended, and some cordial was administered, but it failed to remove from her mind the presentiment that any further proceeding at present would be fatal. In this state of remarkable agitation I resolved not to proceed, and informed her that with such fears as she then entertained, the result was to be dreaded. The wound was then dressed, and she was put in bed, faint and exhausted.

After recovering a little, I apprised her that this was only preparatory to the most important part of the operation, and that what had been done would prove of little or no benefit to the disease, and urged her seriously to consider of it, and if possible make up her mind to submit to the performance of the remaining part, which should by no means be deferred longer than the following day.

One o'clock, P. M.—She is still pale, and in a cold sweat; pulse has not recovered itself; and when asked, nodded that she felt some uneasiness.

Seven o'clock, P. M.—Much more collected; pulse natural; no uneasiness whatever, except some obtuse pain about the wound in

breathing, and in swallowing saliva; no increase of heat; left a student to watch with her through the night, and again took leave, earnestly recommending to her private consideration the expediency of submitting to the remainder of the operation.

18th.—Seven o'clock, A. M.—Found her this morning in a very composed state of mind; having slept well, and free from fever. Upon putting the question, would she submit to the remainder of the operation? she nodded assent with much apparent decision, and said she was determined to undergo it.

At ten o'clock, finding my patient cheerful and resolute, she was again placed upon the table, and, in the presence of Wm. Anderson, surgeon, the late Dr. Hosack, and a number of other gentlemen, the operation was continued. Feeling for the condyloid process, an incision was commenced upon it, opposite the lobe of the ear, carried downwards over the angle of the jaw in a semicircular direction along the lower part of the tumor, as it rested upon the thyroid cartilage, and terminated at about half an inch beyond the angle of the mouth, on the chin. The termination of this incision upon the chin, was just above the attachment of the under lip to the bone, and the mouth was thereby laid open. I now extracted the second incisor tooth of that side, as it was in a sound part of the bone, and, after separating the soft parts from the side of the chin, and laying bare the bone, I introduced a narrow saw, about three inches long, similar to a key-hole saw, from within the mouth, through the wound, and sawed through the jaw-bone from above downwards. The lower part of the tumor was then laid bare, by cutting through the mylo-hyoid muscle, and the flap of the cheek carefully separated and turned up over the eye. This exposed fully to view the whole extent of the tumor as it rose upwards to the *os malæ*. After the integuments were carefully dissected from the parotid gland, the masseter muscle was detached from its insertion, until it came to the edge of this gland, then separating a thin plane of the fibres of this muscle, I now readily raised the parotid, without wounding it at this part. The maxilla inferior was now laid bare just below its division into two processes, and it appeared sound. To facilitate the sawing of the bones, it was necessary to make a second incision, about an inch long, close to the lobe of the ear, and terminating at the edge of the mastoid muscle; then, with a fine saw made for the purpose, smaller and more convex than Hey's, I began to saw through the bone, obliquely downwards and backwards, and finished with one less convex. The latter part of the sawing was done with great caution, to avoid excruciating pain from the laceration of the inferior maxillary nerve. When the bone was sawed through, the two processes were observed to be split asunder, and the coronoid to be drawn up by the action of the temporal muscle.

An elevator was now introduced where the bone was divided at the chin, by which the diseased portion was raised, when, with a scalpel passed into the mouth, the tumor was separated from the side of the tongue, as far back as the posterior fauces, from the

velum pendulum palati and pterygoid processes. This loosened it very much, so that it could be turned upon the side of the neck. It was then separated from the parts below the base of the jaw, and also from the pharynx, and detached at the posterior angle, carefully avoiding the trunk of the internal carotid and deep-seated jugular vein, both of which were exposed.

The diseased mass, being now separated above and below, was turned up, the pterygoid muscles detached, and the third branch of the fifth pair of nerves divided from below, a little above the foramen at which it enters the bone. By this manner of proceeding, with a constant reference to this nerve, I apprehend my patient was saved from much acute pain, and the nerve more safely divided, than at an earlier stage of the operation.

At several periods of this operation, the curved spatulas, used in my operation upon the *arteria innominata*, were found very useful, particularly in elevating the parotid gland, and keeping the tongue steady, whilst the tumor was being separated from it.

Very little blood was lost during this operation. Two arteries only of any size were divided, the facial and lingual; and these only required the ligatures at the branch extremities; but each end was tied for safety. Another small artery behind, and a little underneath the posterior angle of the jaw, yielded some blood and was tied.

The flap of the cheek was now brought down, after waiting a few minutes to observe if any hemorrhage should come on, and secured in close apposition by three sutures, and adhesive straps. Lint, a compress, and the double-headed roller, completed the dressing. She was made as comfortable as possible upon the table, and directed to remain a few hours to recruit, and to be more convenient in case any hemorrhage should make it necessary to remove the dressings.

At eight o'clock in the evening, I found her removed to a bed, and in a comfortable situation. Some reaction of the circulation had taken place, but there had been no hemorrhage. The pain from the operation, she said, was less than she expected. For the first time, since the operation, she sipped three tea-spoonfuls of cold water, and gave evidence, by a nod, that she could swallow. Directed one hundred drops of tinct. opii to be given, if any twitching, more pain, or restlessness, should supervene.

19th.—Seven o'clock, A. M.—Found her quite free from fever and irritation, and, in every respect comfortable. Swallows cold water by the tea-spoonful with but little inconvenience. Did not take the tinct. opii last night. Slept several hours during the night.

Twelve o'clock, at noon.—Is comfortable; skin moist; pulse less frequent, and soft; directed an enema to be administered of soft-soap and water; has a little more difficulty in swallowing, but none in breathing.

Nine o'clock, P. M.—As well as in the morning. Enema operated three times, and relieved her. Pulse frequent, but not tense.

She has taken about two ounces of cold water by the tea-spoonful since daylight.

20*th*.—Seven o'clock, A. M.—Had a very comfortable night. This morning, instead of nodding, she answers "yes" and "no" to the several questions in an audible whisper.

Nine o'clock, P. M.—Much as in the morning.

21*st*.—Nine o'clock, A. M.—As comfortable as yesterday morning.

Nine o'clock, P. M.—No material alteration.

22*d*.—Nine o'clock, A. M.—Directed an enema to be administered as before. Allowed her to take, in addition to her cold water and teas, some thin chicken soup: is in every respect doing well.

Nine o'clock, P. M.—Tumefaction of the lips and cheek very trifling, not enough to effect the least change in the eye-lids of the right eye.

23*d*.—Is in every respect comfortable.

24*th*.—Eleven o'clock, A. M.—Makes no complaint; dressed the wounds; union by adhesion has taken place in the whole extent, excepting about the ligatures and sutures. Suppuration having come on about two of the sutures, they were removed. Pulse about 120. Renewed the adhesive straps with lint interposed between them and the wound, and the double-headed roller.

25*th*.—Every way comfortable. Pulse 120.

26*th*.—Says she has no complaint to make. Pulse 80. Directed her to take a small dose of sulphate of magnesia.

27*th*.—Speaks audibly, and says she is very well. Pulse about 84.

28*th*.—As well as before; dressed the wounds; removed the two sutures at the upper part near the ear; wounds appear healed at every part, except where the ligatures remain upon the arteries. Pulse 80.

29*th*.—Feels very well; speaks distinctly; takes freely of soup and other thin food. Pulse 100.

Dec. 3*d*.—Ligature from the carotid came away, and the other three ligatures from the upper wound. A small collection of matter was evacuated from under the integuments in the lower wound, which was produced by the irritation of the ligature.

4*th*.—Speaks and swallows very well; wounds just healed. Has used for some days a wash of spirits and water to the month, with a view to correct some fætor of the saliva, and cleanse the mouth.

6*th*.—Found her dressed and sitting in an adjoining room, reading by the fire; looks and says she is very well. The bandages being all left off, the only deformity apparent is a little more tumefaction of the right cheek than the left; wounds just well; can move very readily the sound half of the under jaw. Permitted her to chew some animal food.

10*th*.—Wounds all healed; makes no complaint.

March, 1822.—To-day having visited her, I found scarcely any perceptible deformity. The right cheek appeared, upon close ex-

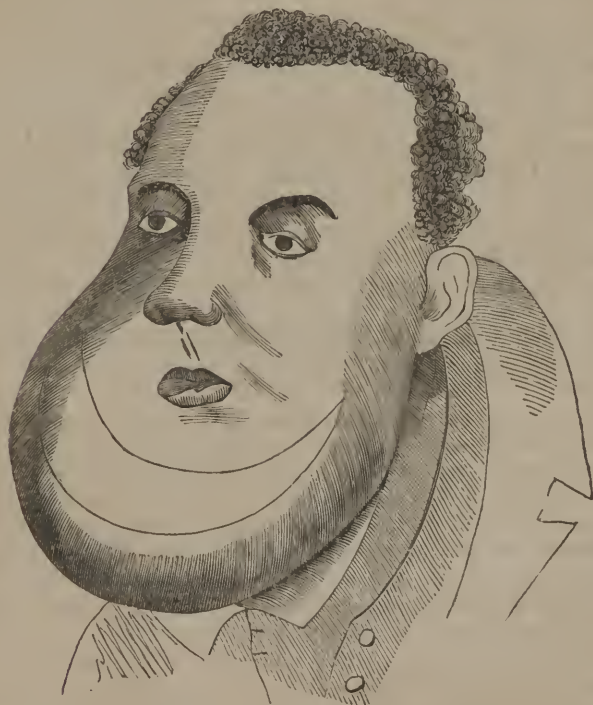
amination, to be a little more depressed than the left. I felt from within the mouth some osseous deposit to have commenced at the two situations at which the bone was divided. Her health in every respect is perfectly good, and she enjoys the free use of the left side of the lower jaw.

Nov. 5th.—I have repeatedly heard of and seen the patient during the past season, and she continues to enjoy uninterrupted health.

No. II.—MAY 15, 1823. CASE OF EXSECTION AND DISARTICULATION OF THE LOWER JAW IN THE NEGRO MAN PRINCE, (See New York Medical and Physical Journal, Oct., Nov. and Dec.; 1823; Vol. II., p. 401-405. *One plate.*)

In this case the disease was of prodigious magnitude, and the bone removed at the articulation on the right side.

Prince, a colored man, aged eighteen years, was sent me from New Jersey, with an *osteo-sarcomatous* tumor, embracing the lower



jaw-bone from the articulation of the right side, as far as the alveolar socket, supporting the first molar tooth of the left. It presented an appearance in size equal to that of his head.

At the age of twelve an enlargement of the bone showed itself

about the situation of the second molar tooth of the right side. This was at first considered a gum-bile, but it gradually increased, dislodging one after another, the teeth in its neighborhood. When it had arrived at the size of a walnut, a lancet was put into it, but no pus or fluid issued. In 1818, when as large as a goose-egg, it was again opened, and a small quantity of blood and matter was discharged. During its progress it was slightly painful, until some time before the operation, when it became the cause of much uneasiness. Latterly two or three small openings had taken place within the mouth, attended with a discharge of pus and ichor, by which were denuded several boney spiculæ. Externally, near the most depending part, an ulceration of the skin had taken place, from which had been discharging daily for some weeks several ounces of thin matter, and through which a probe would readily pass to some distance into the substance of the tumor.

The size of the tumor in the mouth was such as to reach completely over to the left cheek, carrying the tongue along with it, so that the latter lay flatwise between the tumor and the cheek. Deglutition was extremely difficult, and confined to liquids in small quantities. These glided along between the tongue and left cheek, when the head was very much inclined to the left side. No appearance of fauces could be observed upon opening the mouth.

From the long continuance of this disease, and the great emaciation which attended it, very little hope could be entertained from so formidable an operation as would be required for the removal of such an enormous mass. Still, as I knew he would soon perish with it, and being very desirous himself to take what little chance there was, I determined to give it him, and accordingly performed the following operation:—

May 15th, 1823.—At noon of this day, I tied the right carotid artery, a little above the clavicle. He bore the operation with great firmness, and appeared to be but little exhausted by it. After resting and refreshing himself with a little wine, he wished it to be continued.

An incision was now commenced at the lower edge of the *jugum temporale*, and carried in a semicircular direction over the most prominent part of the tumor, and terminated opposite the first molar tooth of the left side. Another incision of the same form, but of less extent, below this, left a large piece of integument in which was situated the ulceration. (*See Plate.*) The flaps being dissected from the tumor, the second bicuspid tooth of the left side was extracted, and the bone here sawed through at a sound part, with the saw which I had provided for the other cases.

Raising with an elevator the bone where sawed through, the diseased mass was cautiously dissected from the tongue, palate and pharynx, until the joint upon the right side was exposed; the capsular ligament was now divided on the inner side, by which the bone was easily removed from its articulation. In the course of this part of the operation very little blood was lost, it being necessary only to apply four ligatures. This would seem to answer in

the negative the query put in the former case concerning hemorrhage.

The patient was much exhausted by this operation, which, from the great extent of the disease, necessarily occupied a considerable time. His exhaustion was also to be ascribed to his previous state of debility.

After his recovery from the exhaustion the flaps were brought together by several interrupted sutures and adhesive plasters, and the double headed roller being applied, he was put to bed.

The tumor weighed *twenty-two ounces avoirdupois*.

Three o'clock.—Has continued to recover gradually from the shock of the operation.

Five o'clock.—Fell into a sleep of about half an hour, and has awaked much better. Pulse regular and distinct.

Eight o'clock.—Pulse 140, and regular; skin cool and moist; signifies by a nod that he is more comfortable than he expected to be. Has spoken pretty distinctly for several things, contrary to particular orders; swallowed some water from the spout of a teapot without much difficulty. Requested two pupils to remain with him during the night.

16th.—Ten o'clock, A. M.—Slept most of the night quietly, only taking a little cold water once; skin of the natural temperature; pulse 120, and stronger than last evening. Nods that he is much more comfortable; ordered him to take a little cold water occasionally when necessary, but to take it as seldom as possible.

Ten o'clock, P. M.—Pulse 124, and fuller; skin pleasantly warm; articulates that he is quite comfortable, and feels refreshed from his sleep; has had considerable sleep through the day, and is now sleeping very quietly. Swallows very well when the fluid is conveyed into the posterior fauces by an elastic tube and bottle. He introduces the tube himself as far as is necessary, for the purpose of swallowing without producing any action of the lips or muscles of the face. Contrary to orders, got out of bed to have an evacuation from his bowels and pass urine, which he accomplished without difficulty.

17th.—Ten o'clock, A. M.—Has had a good night; pulse 120; skin nearly natural; swallows with more difficulty, and some of the liquid passes through the wound. Removed the bandage and adjusted all the dressings anew, as they had become wet. Takes soup and chocolate as his drink; bowels have been moved again spontaneously; has a slight cough.

Nine o'clock, P. M.—Says he is as comfortable as in the morning; pulse 124; has slept a good deal in the course of the day, and says he feels much strengthened by it.

18th.—Ten o'clock, A. M.—Passed a good night, and says he is quite as well as yesterday; swallows better; pulse 130.

Ten o'clock, P. M.—Not as well as in the morning; pulse from 135 to 140 in a minute; coughs more frequently; respiration considerably hurried; is very restless, and feels very faint at times. In the course of this afternoon, during a very heavy thunder-shower,

he fainted, and appeared to be threatened with immediate dissolution; but after a short time revived, by the use of volatiles and fanning; says he feels considerable pain on the left side, which prevents him from taking a full inspiration; indeed, every breath is painful, as is evinced by the distress of his countenance. Ordered a blister to be applied immediately to the side.

19th.—Ten o'clock, A. M.—Is much relieved by the drawing of the blister; slept a good deal during the night; had one fainty turn in the course of the night. Dressed the wound this morning; more than two-thirds of the wound had united by adhesion; breathing much better; pulse from 132 to 140; cough less troublesome; swallowed some chocolate very well.

In the course of the day his cough and breathing became more troublesome, with great anxiety and restlessness; and at four o'clock in the afternoon, in one of his turns of faintness, he expired.

Not being able to attend to the dissection, I requested my friend, William Anderson, Esq., Surgeon, to examine the body the next morning: who has obligingly handed me the following particulars:

"The wound appeared healthy, and had united by adhesion through most of its course.

"*Dissection.*—Upon raising the sternum, there was found in the anterior mediastinum a massy deposit of coagulable lymph through its whole extent. This was of a yellowish hue, having the exact appearance of pus, but wanting its fluidity. In the cavity of the pericardium was contained a pint of yellow serum, and each lung exhibited marks of high inflammation throughout their whole extent, the surfaces of both being of a deep purple, and in some places of a florid hue. There was, however, in no place any adhesion between the lungs and the sides of the chest."

No. III. JUNE 17th, 1828.—AN ACCOUNT OF A CASE OF OSTEO-SARCOMA OF THE LEFT CLAVICLE, in which *Exsection* of that Bone was successfully Performed, by Valentine Mott, M. D., &c. (See *American Journal of the Medical Sciences*, Philadelphia, 1828, Vol. III., p. 100–108.)

On a former occasion, the author of the following paper laid down the principles which ought to govern a surgeon in relation to operations generally, and gave, in illustration, an account of a successful amputation at the hip-joint. (See *supra*, this vol.; also *Phil. Med. and Phys. Jour.*, Vol. XIV., p. 101.) Since then, he has enjoyed the satisfaction of seeing the same views beautifully illustrated by Dr. Barton's excellent operation for the production of an artificial joint, (*Id.*, p. 177,) and has himself presented a further illustration in the successful ligature of the common iliac artery. (See *supra*, this vol.; also *Jour. of Med. Sc.*, Vol. I., p. 156.) The instance now to be adduced, is of a character to supply all the confirmation desirable to the establishment of any such principle; and we think it may henceforward be regarded as an *axiom*, that it is the duty

of a surgeon to operate *in every case* which allows of a rational hope of success, either of improving the patient's condition, or of preserving his life. It is almost superfluous to add, that in arriving at this conclusion, we do not believe it proper for every man who is *nominally* of the profession to assume such high responsibilities; but, that we regard those as *surgeons*, and those alone, who have, by conscientious devotion to the study of our science, and the daily habitual discharge of its multifarious duties, acquired that knowledge which renders the mind of the practitioner serene, his judgment sound, and hands skilful; while it holds out to the patient rational hopes of amended health and prolonged life.

William B. Yates, of Charleston, S. C., aged nineteen years, of a plethoric habit, consulted me on the 26th of May last, respecting a tumor situated on the left clavicle.

He stated, that on or about the 1st of February, 1828, he discovered a small tumor, as large as a pigeon's egg, very hard and immoveable, in the left clavicle; no pain whatever attended it, and the skin was of its natural color. He can assign no cause to which it could be attributed; he had always enjoyed good health; he recollects, however, having sprained his arm a short time before he first observed the tumor, but does not ascribe it to that, as it might have existed previous to the accident, and unknown to him. He applied immediately to a physician, who pronounced it an encysted tumor, and applied warm salt-water; which, not producing any good effect, blisters, poultices, a seton, and escharotics, were resorted to, but without retarding in the least its growth. These remedies debilitated him so much, as to prevent him from taking ordinary exercise. But during his passage to New York, he regained his, in some degree, former energy, and has since enjoyed pretty good health.

On examination, a conical tumor, about four inches in diameter at its base, and of an incompressible hardness, was found on the anterior portion of the clavicle, to which it was firmly attached; the apex of the tumor was covered with luxuriant fungous granulations, the consequence of the above applications, from which profuse bleedings from time to time took place.

The rapid increase of the disease led him to request that some operation should be performed, preferring to submit to a new and uncertain operation, rather than perish with the terrible disease that now threatened his existence. All the circumstances were candidly stated to him, both by Dr. Barrow, who was associated with me in the case, and myself—that the operation was without a precedent—that it was impossible for me to say the disease could be eradicated—if it could, it would be exceedingly difficult and dangerous—that the operation would be very complicated, as the parts connected with it were of the greatest importance to life, and involved the most important structure. Nevertheless he was perfectly resigned, and resolved to submit to a doubtful remedy. With a composure and fortitude which has rarely been equalled within my observation, he said he had resolved to take the chance of the

operation, and disregarded the pain and suffering to which he must be subjected.

On the 17th of June, between eleven and twelve o'clock, A. M., he was placed upon a table, with his shoulders a little elevated, inclining to the left side. Assisted by Dr. Barrow, Dr. Proudfoot, and Dr. A. E. Hosack, in the presence of Drs. Hull, Storer, Leveridge, Pratt, and a number of my pupils, the following operation was performed :—

An incision was commenced over the articulation of the clavicle, with the sternum, and carried in a semicircular direction, as close to the fungous projections as the sound integuments would admit of, until it terminated on the top of the shoulder, near the junction of the clavicle, with the acromion process of the scapula. This incision exposed the fibres of the pectoralis major, which was divided as near the tumor as possible ; in accomplishing this, as well as the first incision, arteries sprung in every direction, and required ligatures. A number of large branches of veins, under this muscle, emitted blood freely, and required to be tied.

In conducting the incision through the pectoral muscle, towards the scapular extremity of the clavicle, care was taken to avoid the cephalic vein, as it passes between this and the deltoid muscle. A small portion of the latter muscle was detached from the clavicle, which readily allowed the vein to be drawn outward towards the shoulder.

On attempting to pass the forefinger under the vein and deltoid to the lower edge of the clavicle, it was found impracticable, as the hard osseous part of the tumor extended beyond this point, and was completely in contact with the coracoid process of the scapula.

Finding it impossible, from the size of the tumor and its proximity to the coracoid process, to get under the clavicle in this direction, an incision was made from the outer edge of the external jugular vein, over the tumor, to the top of the shoulder. After dividing the skin, platysma myoides, and a portion of the trapezius muscle, a sound part of the clavicle was laid bare at a point nearer the acromion than a line with the coracoid process ; a steel director, very much curved, was now cautiously passed under the bone from above ; which, from the firm boney state of the tumor at this part, had a considerable obliquity outwards. Great care was taken to keep the instrument in close contact with the under surface of the bone. The depth of the bone from the surface, rendered it somewhat difficult to accomplish this safely : an eyed-probe, similarly curved, conveyed along the groove of the director a chain-saw, which, when moved a little, showed that nothing intervened between it and the bone ; the clavicle was then readily sawed through.

The dissection was now continued along the under surface of the tumor, below the pectoralis major ; here a number of very large arteries and veins required tying. The first rib being next exposed under the sternal extremity of the clavicle, the costo-clavicular or rhomboid ligament was divided, and the joint opened from the lower part. This gave considerable mobility to the diseased mass,

and encouraged us to believe that its complete removal would be practicable.

By means of a double hook and elevator, with the assistance of our strong and very broad spatulas, properly curved, we were enabled to elevate a little the sawed end of the clavicle. After loosening the parts about it, by keeping close to the tumor, we wished to discover the subclavius muscle, as it is inserted in the bone about this situation; but it could not be seen, as it was incorporated with the diseased mass. Had this muscle been found, the separation of the tumor would have been much less difficult and tedious, as, by keeping above it, the subclavian vein is of course protected. The origin of this muscle, from the cartilage of the first rib, was seen and divided, but it was almost immediately obliterated in the tumor.

Continuing the removal of the tumor at the upper and outer part, the omo-hyoideus was found lying under it, which we exposed from where it passes under the mastoid muscle, to near its origin from the superior costa of the scapula. In separating the tumor from the cellular and fatty structure, between the omo-hyoid muscle and the subclavian vessels, a number of large arteries were divided, which bled freely, and particularly a large branch from the inferior thyroïdal.

The anterior part of the upper incision was now made from the sternal end of the clavicle, and carried over the tumor, until it met the other at the external jugular vein. After cutting through the platysma myoides, this vein was carefully separated from the surrounding parts, and two fine ligatures passed beneath it, and tied a short distance from each other; the vein was then cut between the ligatures.

The clavicular part of the sterno-cleido-mastoideus was next divided, about three inches above the clavicle in the direction of this incision. The deep-seated fascia of the neck being now exposed, the mastoid muscle, and the diseased mass, were very cautiously separated from it, until the anterior scalenus was exposed.

The subclavian vein, from the edge of the scalenus anticus to the coracoid process, was so firmly adherent to the tumor, as to lead me at one moment to believe that the coats of the vein were so intimately involved in the diseased structure, as to render the complete removal of the morbid part utterly impracticable. By the most cautious proceeding, however, alternately with the handle and blade of the knife, we finally succeeded in detaching the tumor, without the least injury to the vein. This part of the operation was attended with peculiar danger and difficulty. At every cut, either an artery or vein would spring, and deluge the parts until secured by ligatures. Besides several large veins, the external jugular was so situated in the midst of the boney mass, as to require two more ligatures in this place, near to the subclavian, and it was again divided in the interspace. Near the sternal end of the clavicle, a large artery and vein required tying; they were considered as branches of the inferior thyroïdal artery and vein.

From having cut through the clavicular portion of the mastoi-

deus muscle, obliquely upwards and outwards a little above the tumor, we were enabled, by turning this down and keeping close to the fascia profunda, to detach the tumor from over the situation of the thoracic duct and junction of the internal jugular and left subclavian, without the least injury to these important parts.

To reach the lower part of the tumor as it extended upon the thorax, it was necessary to separate the pectoralis major in a line with the fourth rib, and to make a transverse incision two inches in length through the integuments and muscles at about its centre. The incision upon the neck extended from the sterno-clavicular junction in a semicircular direction, to within an inch of the thyroid cartilage and base of the lower jaw, and two inches from the lobe of the ear, and terminated near the junction of the clavicle and scapula.

The fungous and bleeding character of the apex of the tumor implied that it was freely supplied with vessels. The discharge of blood was so free at every step of the operation, that about forty ligatures were applied. It was estimated that the patient lost from sixteen to twenty ounces of blood.

All the parts now presenting a healthy appearance, the ligatures were cut close to the knots, and the cavity of the wound filled with lint. Long strips of adhesive plaster were applied, to prevent the edges of this extensive wound from further retracting; a light compress, a single-headed roller loosely applied around the chest and shoulders, completed the dressing.

He was placed in bed upon his back, inclining a little to the right side, with the head considerably elevated, whilst the left shoulder and arm were supported by a pillow.

I requested two of my promising pupils, Messrs. Thomas G. Swain of New York, and John W. Schmidt of Charleston, S. C., to remain with him during the day and following night; and such was the interest which his case excited in their minds, that they remained in the room with him night and day for the first week. To their unwearied attentions I am indebted for the following report of his symptoms:—

June 17th, 1828, 7 o'clock, P. M. Feels comfortable, except being nauseated by the wine and water given him during the operation, which he says generally produces this effect upon him. Some reaction is indicated. Between 7 and 8, P. M., took two cups of gruel, and has since vomited a little. 9 P. M. Pulse 110; skin moist and cool. He feels tolerably comfortable, and is much gratified that the operation has been performed. Took a little mint tea, which was grateful to him. 12 P. M. Has had a short repose; drank some mint tea, and feels quite comfortable; pulse 128; thirst considerable.

June 18th, 3 A. M. Has had a comfortable sleep, during which there was considerable hemorrhage from the wound; pulse 120, hard and full. 8 A. M. Took a cup of tea, ate a piece of toast, with a few strawberries; feels better than previous to the opera-

tion; pulse 124. 12 P. M. Has slept during two hours, and is now in a comfortable sleep; pulse 130; skin moist and warm.

June 19th, 4 A. M. Feels much refreshed; administered the following:—R., Sulph. magnes. $\frac{3}{4}$ ss.—calc. magnes. 3 j. M. dissolved in a small quantity of water. 10 A. M. Another cathartic directed, which produced an evacuation at 2 P. M., and afforded much relief. 9 P. M. Has taken toast and tea, and has a good appetite; pulse 124, and much softer; copious discharge from the bowels; febrile symptoms less.

June 20th, 3 A. M. Skin moist and cool; appetite good; pulse 120. 9 P. M. Pulse 106; bowels free; feels comfortable.

June 21st, 2 A. M. Thirst much abated; skin moist and cool; has slept well. 9 A. M. The bandage and part of lint removed, it being a little fetid; inflammation moderate, and accompanied with a slight suppuration; bowels being somewhat torpid, the following medicine was prescribed:—R., Pulv. rhei.—mag. calc. $\frac{1}{2}$ 3 iss.—sacch. alb. $\frac{3}{4}$ j.—aqua menth. pip. $\frac{3}{4}$ ij.—took two table-spoonfuls every hour, which operated at half-past one copiously.

June 22d, 9 A. M. Has had small evacuations from the bowels; slept well and comfortably; pulse 108; the dressings were removed, except a small pledget of lint at the bottom of the wound, over which an emollient poultice was applied.

June 23d, 9 A. M. Has slept comfortably; pulse 109, soft and full; skin natural. Ordered the following cathartic:—R., Sulph. magnes. $\frac{3}{4}$ ss.—magnes. calc. 3 j.—which was repeated in the afternoon.

9 P. M. Medicine has operated copiously; pulse 99, softer and more natural; skin pleasant; tongue clean; renewed the poultice.

June 24th, 9 A. M. Symptoms the same; bowels have been opened; removed some of the remaining lint; applied a fresh poultice; removed him to another bed, for the purpose of airing his; no inconvenience from the removal; takes toast and tea, gruel, &c., through the course of the day.

June 25th, 9 A. M. Pulse 98; tongue clean; bowels torpid. Ordered a Seidlitz powder every hour till it operated; he took seven.

June 26th, 9 A. M. Pulse 95; slept well during the night; patient expressed a desire to eat; gave him some chicken broth, which was very palatable.

June 27th, 9 A. M. Pulse 84; at 10 o'clock administered an enema, which produced copious evacuations.

June 28th, 9 A. M. Took some strawberries, toast and tea; takes $\frac{3}{4}$ viij. of the infusion of cinchona through the day.

June 29th, 9 A. M. Pulse soft and full; bowels torpid. 9 P. M. An enema administered, which produced copious evacuations.

June 30th, 9 A. M. Pulse 95, full and hard; the wound is dressed every morning; it is now nearly half filled with healthy granulations. The skin much contracted; some ligatures have been removed, others quite loose. He requires an enema every other evening, to keep his bowels open.

July 1st. Pulse 100 ; injection produced copious evacuations of a natural appearance.

July 2d. Permitted him to eat meat ; pulse natural ; wound continues to fill up rapidly with healthy granulations ; continues to take the cinchona $\bar{3}$ viij. per diem.

July 3d. Feels in every respect much better ; pulse natural ; skin moist ; experienced a slight indisposition from a cold produced by a sudden change in the weather. Directed him a dose of the eccoprotic mixture.

July 4th. Wound has a healthy appearance ; cicatrization has commenced ; seven ligatures were removed ; dressed it with lint, over which a compress was applied.

July 5th. Sets up in bed with ease ; two ligatures removed.

July 6th. An apparatus applied yesterday to support the arm. No unfavorable symptoms have appeared.

July 7th. A number of ligatures were removed to-day.

July 8th. Bowels require no more injections at present. Wound nearly filled, and is very florid and healthy in its appearance.

July 9th. The cut end of the remaining portion of the clavicle is perfectly sound and healthy.

July 10th. Continues to improve in strength ; bowels still regular ; skin pleasant ; tongue clean ; pulse natural.

July 11th. The slight catarrh, complained of a few days since, has entirely left him.

July 13th. The end of clavicle entirely covered with healthy granulations.

July 14th. The ligatures remaining are very few ; wound contracted astonishingly ; nearly filled with very florid and healthy granulations. Walked down stairs to dinner yesterday and to-day without the slightest inconvenience.

July 15th. The patient goes about the house with his arm in a sling and the apparatus to support the shoulder.

July 16th. No more ligatures remaining ; the granulations rising above one part of the integuments, require pressure. Continues the infusion of bark.

He continued to improve in general health, and the wound gradually filled up, until the middle of August, when he left the city on an excursion of pleasure to the Springs at Saratoga. He returned in September, in better health than he had ever enjoyed.

The tumor is about the size of a man's doubled fists, or of a circumference just to allow me to grasp it with my fingers fully extended. It consists of a boney cup, incompressibly hard at all parts, except superiorly and inferiorly to a small extent. From an opening of an elliptical shape at the upper part, protruded a bleeding fungus, of the size and shape of half a hen's egg. At the under surface, as it lay upon the great subclavian vessels, the boney character is less manifest ; the structure about the centre particularly appearing to be cartilaginous or semi-osseous. This boney enlargement occupies the clavicle from the sternal articulation to within half an inch perhaps of the acromial extremity. From the

motion which can be given to each end of the clavicle, the natural structure of the bone seems to be entirely destroyed.

This operation far surpassed in tediousness, difficulty, and danger, any thing which I have ever witnessed or performed. It is impossible for any description which we are capable of giving, to convey an accurate idea of its formidable nature. The attachment of the morbid mass to the important structure of the neck and shoulder of *the left side*, and to so great an extent, is sufficient to indicate its magnitude and difficulty.

The extensive nature of this operation, led us to take the precaution of securing the external jugular with a double ligature, and dividing it between them. Though in operating upon the neck we have several times cut these veins without any unpleasant consequences, we however think we have witnessed almost fatal effects from the division of a large vein, and the admission of air into the circulation.

The case of Baron Dupuytren's, in which a young woman suddenly died under an operation, from the division of a large vein in the neck, whilst he was engaged in removing a tumor, contributed, with my own experience, to make me take the precaution of previously tying the vein in this operation.

In an attempt which I made to remove the parotid gland in an enlarged and scirrhus state, the facial vein, where it passes over the base of the lower jaw, was opened in dissecting the integuments from the tumor, in the early stage of the operation, before a single artery was tied. At the instant this vessel was opened, the attention of all present was arrested by the gurgling noise of air passing into some small opening. The breathing of the patient immediately became difficult and laborious, the heart beat violently and irregularly, his features were distorted, and convulsions of the whole body soon followed, to so great an extent as to make it impossible to keep him on the table. He lay upon the floor in this condition for near half an hour, as all supposed in *articulo mortis*. As the convulsions gradually left him, his mouth was permanently distorted, and complete hemiplegia was found to have ensued. An hour and more elapsed before he could articulate, and it was nearly a whole day before he recovered the use of his arm and leg. From a belief that these effects arose from the admission of air into the blood-vessels, which was not doubted by any person present, I instantly called to mind a set of experiments, which I made some twenty years since upon dogs, by blowing air into the circulation, by inserting a blow-pipe into a large superficial vein upon the thigh, and was forcibly struck with the similarity of result.

To the extraordinary composure of mind which our patient manifested, is to be attributed in a great measure his undisturbed and speedy recovery. No adverse symptoms, of a general or local nature, took place to interrupt the process of granulation in the wound. The immense chasm which was left, and such important parts as have been described, being only covered with lint, necessarily occa-

sioned me great solicitude, until I saw suppuration fully established, and the great vessels covered by granulations.

No difficulty attended keeping his shoulder in a proper position, by the use of the common apparatus for fractured clavicle. With this he walked about without any inconvenience, after four weeks had elapsed; and two months from the time of the operation, he was able to discontinue the sling, and by means of an apparatus contrived by Mr. James Kent, a most ingenious and inventive artist, to supply the want of clavicle, he was so fitted as to have his shoulder in its proper position, at the same time that the full motion of his arm was preserved.

Professor Mott's case of Exsection of the Clavicle. (Extract of a letter from Dr. A. F. Vaché, of New York, to Dr. Hays. See *Phila. Amer Journ. of the Med. Sc.*, vol. VII., p. 271, year 1830.) You express a desire for a continuation of the case of exsection of the clavicle, or rather for a report of its result. It gives me much pleasure to state its successful termination, and the perfect health of the gentleman upon whom it was performed. About two months ago, while on an excursion of pleasure to New York, he called at Dr. Mott's, and I examined his shoulder. He remarked that he continued to wear the mechanical contrivance until the anniversary of the performance of the operation, when he laid it aside, not finding it any longer necessary. On examination, I found that the small acromial portion of the clavicle, which had not been removed by the operation, had formed permanent adhesions with the surrounding parts, and maintained the shoulder in its natural position. He had perfect use of the arm in all its motions, and the cicatrix was all that appeared to indicate any operation ever having been performed.

It is proper in point of time to insert the following in this place :

Extract from the Report of a Committee, upon the subject of OSTEO-SARCOMA OF THE LOWER JAW, to a Medical Society of New-York, April 1, 1830; D. L. RODGERS, M. D., Chairman. (See *American Journal of the Medical Sciences: Philadelphia*, 1830, Vol. VI., p. 533—534.)

The committee to whom was referred the subject of "Operation upon the Lower Jaw," for "Osteo-Sarcoma," report, That they have diligently examined the subject submitted to their inquiry, and have found much difficulty in fixing the date of the different operations, and in settling the priority of claims. The operation for removing the lower jaw for osteo-sarcoma has been so frequently performed, and so well established, that it is deemed unnecessary at this time to discuss the propriety or practicability of the operation; we shall therefore confine our investigations to the subject particularly referred to your committee, viz. "To whom are we indebted for the introduction of this operation?" In the examina-

tion which your committee have bestowed upon this subject, they have not been able to find in the records of surgery a single case in which a portion of the lower jaw was removed for osteo-sarcoma, or even a proposition to that effect prior to the year 1818. In the *Dict. des Sciences Médicales*, for 1818, the operation for removing the lower jaw for the cure of osteo-sarcoma is seriously proposed, and an allusion is made to several cases which proved fatal, and the casts of which are to be seen in the College of Medicine at Paris. But no intimation is there offered of the operation ever having been performed for the removal of this disease. The credit of first removing the lower jaw has generally been given to M. Dupuytren. It is true this distinguished surgeon removed a portion of the lower jaw for a "Cancerous Affection of the Gums" in 1812. This case was reported by M. Lisfranc to the Faculty of Medicine at Paris in 1813. This report of M. Lisfranc is republished in the *Dict. des Sciences Médicales*, for 1818, t. XXIX., p. 430, who describes the case throughout as a case of cancer, and accurately describes its origin, extent, and connections, under the name of "Carcinome." It is evident from the silence that was observed upon the subject by the French writers, that it was not considered of much importance, as the case was found among the archives of the Faculty of Medicine, and not brought forward until the year 1818. It is mentioned in general among the diseases of the lower jaw, in connection with caries, osteo-sarcoma, &c., and it was at this time, when relating the operation of M. Dupuytren, that a removal of a portion of the lower jaw for osteo-sarcoma was proposed. The operation of M. Dupuytren was for a different disease, and of smaller extent when compared to those performed for osteo-sarcoma. It is evident that this operation of M. Dupuytren cannot give him a prior claim to the removal of the lower jaw for osteo-sarcoma. If the removal of a portion of the bone is to establish the claim, then Dr. Whitridge might with as much propriety claim originality, as he extracted one-half of the inferior maxillary bone for a necrosis; Decker removed two-thirds of the lower jaw, and his patient recovered. (*Medico-Chirurgical Review*, No. 28, p. 532.) These operations were performed anterior to the one performed by M. Dupuytren, and thus far he has no claim to originality, as there exists no greater resemblance between the operations of Decker and Dupuytren, than in the operations of the latter and those of Professor Mott.

Professor Pattison, who witnessed the operation of the French surgeon, makes the following remark:—"Dupuytren, when I was in Paris, removed a considerable portion of the angle of the jaw in a case where a cancerous sore was situated over it. The extent of this operation was however trifling when compared with those executed by Dr. Mott," (Burns' *Anatomy of the Head and Neck*, Pattison's edition, p. 485.)

From the authorities which your committee have had in their power to consult, they are well satisfied that the operation of M. Dupuytren should not be ranked with those formidable cases reported by Mott, Graefe, and Lallemand. Mr. Burns, in his work

on the Anatomy of the Head and Neck, makes no mention of an operation for the removal of the lower jaw for the cure of osteo-sarcoma.

The first account given of this operation was by Professor Mott in 1822, (*New-York Medical and Physical Journal*, Vol. I.) This operation was performed on the 19th November, 1821. The case was a young woman, "aged seventeen years, of a healthy appearance and good constitution." The Professor gives a detailed and interesting account of the disease. From the great extent of the morbid parts, the vascularity of its structure, and the great danger from inflammation to be apprehended, he considered it a necessary preparatory operation to cut off the current of blood by securing the carotid artery in a ligature; the healing of the wound, and the rapid recovery of the case, is doubtless much indebted to this preparatory treatment; at all events it was of great advantage in preventing an useless loss of blood—by this means preserving the energies of the system, and favoring the rapid closure of the wound. Your committee are conscious that many surgeons have removed portions of the lower jaw without this precaution, and have had cause to regret their bold exhibition of surgical skill; nor do your committee believe that it is necessary to secure the carotid artery by ligature in every case in which a portion of the lower jaw is removed, as several cases are reported in which the operators omitted it; some of these cases were attended with terrible hemorrhage, while others were too insignificant to afford much blood! As an auxiliary in preventing inflammation, no one can for a moment doubt its influence, who has witnessed the effect of cutting off the circulation from inflamed parts. This was in every respect a successful case, and at this date, (1830,) she [the patient] lives in the enjoyment of good health, which is the strongest testimony that we have to offer in favor of the operation. Professor Mott has performed this operation six times—four of which have been successful.

No. IV.—JULY 8TH, 1841.—A NASAL OPERATION FOR THE REMOVAL OF A LARGE TUMOR—FILLING UP THE ENTIRE NOSTRIL, AND EXTENDING TO THE PHARYNX. By *Valentine Mott*, M. D. (See the *American Journal of the Medical Sciences*, Philadel., 1843. New series, Vol. V., p. 87–91.)

When the following operation was announced in the No. of this Journal for January, 1842, I was not aware that any one had operated in a similar case. It having been asserted that Professor Syme, of Edinburgh, had performed the same operation, I immediately addressed a letter to him on the subject, describing my case, and requesting to know if he had met with anything like it. He promptly and kindly replied, and states:—

"You will find a case somewhat similar, in the 9th report of the Edinburgh Surgical Hospital, published in the Edinburgh Medical and Surgical Journal, for 1832, the 34th vol. There is another recorded by M. Flaubert, of Rouen, in the *Archives Gén.*, for August, 1840."

The case, which was published in the Edinburgh Medical and Surgical Journal, for 1832, is of trifling extent compared with the one we have described. The operator first divided the upper lip to the septum nasi, turned the flaps aside, and detached the lip from the jaws so as to expose the tumor without detaching the columna or ala of either side. This he did, "to obtain sufficient room for extracting a large fibrous polypus, which projected both externally and into the pharynx, but did not succeed." He says, "afterwards, when the symptoms had become much more urgent, I removed the superior maxillary bone, as the only means of relieving the patient from the disease."

M. Flaubert, of Rouen, in 1840, performed the formidable operation of exsecting the superior maxillary bone for a large fibrous polypus of the left nostril, extending to the pharynx. Various attempts to remove this morbid mass were made with wires and ligatures, by the operator and his father, with partial success only. This patient recovered completely with very little deformity. (See *Arch. Gén. de Méd.*, for August, 1840.)

Yesterday, I received a small sheet published by Professor Syme, and extracted from the London and Edinburgh Monthly Journal, for Sept., 1842, containing a second operation for nasal polypus. He found this case of a malignant character, and after cutting off the projecting portion of the tumor, the patient was informed that nothing more could be done for his relief, and was discharged from the hospital as incurable. No evulsion was at any period attempted.

After a short time, the patient returned in consequence of repeated bleedings from the tumor, and urged for the sake of his family to have some operation performed, to give him any chance of having his life preserved.

Professor Syme says, "I resolved to try what could be done for the poor man's relief. An incision was made through the upper lip, from the nostril downwards to the mouth, and the flaps were then separated on each side from the gum, so as to afford free space for examining the attachment of the tumor. It then appeared that the growth proceeded from the septum by a narrow neck not larger than a fourpenny piece, immediately above the connection of the cartilage to the bone, and that there was consequently no difficulty in completely rooting out the disease. I cut through the septum a little way above the lower margin, so as not to interfere with the columna, divided the bone with pliers, and separated the remaining cartilaginous attachments. The surfaces of the wound were then brought together, after torsion of the coronary arteries, and retained by stitches of the interrupted and twisted suture. In the course of a few days, there was hardly any perceptible trace of the operation, and the patient has since continued perfectly well."

These are the only three cases of this operation, as far as we know, on record. Two by Professor Syme, and one by M. Flaubert; they have all been successful, and they are all original. In

some particulars they are similar, and yet they are all different. The bones in all the cases were perfectly sound. They are different from what are understood by the upper-jaw operations, as performed by Gensoul and others of Europe, and many surgeons of our own country, in which there is disease of the boney structure, and generally malignant. The present operation, we think, ought to be denominated the nasal, to distinguish it from the ablation or exsection of the upper jaw, for malignant disease of the bone or antrum, or both.

My operation was performed without the knowledge of either Syme's or Flaubert's, and appears to me to be more extensive than theirs, and is as follows :—

Augustus McBurth, cabinet-maker, aged 32, born in Schoharie county, New-York, ten years ago felt a stoppage in his left nostril, accompanied with a dull aching pain, which was much aggravated on taking cold. About one year from the commencement of these symptoms, a tumor made its appearance in the nostril of the same side. At first, it was of a deep red color ; but it gradually assumed a lighter hue, and would occasionally project beyond the anterior opening of the nasal fossæ, especially in damp weather. At this stage of the disease, he came to this city, and placed himself under the care of a surgeon, who made several attempts to remove it by forceps ; but such was the hemorrhage that accompanied each attempt, that it was deemed unsafe to make any further trials to remove it. After remaining in the city three days, he went to an adjoining state, where several trials were made to remove it by means of a ligature ; but as each unsuccessful effort seemed to impart only fresh vigour to its growth, he determined to submit to no further treatment, except to have portions of it removed from time to time, when it should become inconvenient from its size. In 1836, he removed to this city, where parts of it were from time to time removed by forceps and ligature, each attempt being attended with much pain and hemorrhage. His sufferings had now become so exceedingly acute, that for one year he could not sleep in the recumbent position. There was a feeling of distension, conveying the sensation of a wedge forcing forward the jaw bone. In March, 1841, he gave up his business, and urged by the intensity of his sufferings, he was induced to submit to one more trial for its removal by ligature. The wire was in his nose for 11 days, but no benefit resulted from its application. He thinks that from first to last, at least 500 attempts were made to remove it, by about 50 practitioners. In June he applied to me for relief.

The tumor anteriorly and posteriorly, was so firm and dense that very little impression could be made upon it even when firmly grasped by the forceps. After trying several times to get a wire through the nose about the posterior part of the tumor, and getting firm hold of the anterior part with forceps, and the part below the palate with the vulsellum, without being able to make the least impression on it, I determined upon the following operation, having for years

been in the habit of recommending a similar one for the removal of the inferior turbinated bone, when affected with carcinoma.

On *July 8th*, 1841, I commenced an incision through the soft parts a little on the outside of the mesial line of the internal angular process of the os frontis, and extended it downwards to the upper lip

(Fig. 1.)



Fig. 1 gives a good view of the direction of the incisions in the soft parts, with the cheek turned aside;—the dotted lines indicate the course of the sawing of the bones.

which was divided about three lines from the angle of the mouth. Two flaps were then reflected; the inner including the cartilaginous parts of the nose, and the tissues covering the os nasi of the left side; the outer laying bare the bone as far as the infra-orbital foramen. The anterior part of the tumor was now somewhat more distinctly seen, and the nasal cavity was further exposed, by sawing vertically through the os nasi, as far as the transverse suture, so as to avoid the descending plate of the ethmoid. The superior maxillary bone was now divided in a line from the upper part of this cut to a point opposite the second bicuspid tooth, and on a level with the floor of the nostrils. Another section was made from the

termination of the last, extending horizontally inwards towards the vomer. The osseous parts comprising the os nasi, a considerable portion of the superior maxillary bone, and the os spongiosum inferius were then detached.

The connections of the tumor were partially separated; but the disease was so extensive, that a part had to be removed through the anterior opening, before the posterior attachments could be liberated. These having been detached, the larger portion of this extensive disease, which passed into the pharynx and completely plugged up the posterior nares, was removed by introducing through the mouth a large curved vulsellum and forceps, and seizing the mass as it descended into the pharynx.

After the operation, gave sol. sulph. morph. gtt. x. Evening.—Comfortable, and complains of but little pain.

9th. Had slept well, and is much pleased with the freedom of breathing; no febrile excitement; pulse only 69. Comfortable in every respect, and does not complain of soreness of the wound, around which there is but little swelling; has taken some chicken broth; bowels not having been moved, ordered an enema.

10th. Had slept tolerably well, but at intervals during the night suffered considerable pain; some tumefaction of the face today, but not more than is usually attendant on an operation so severe. No febrile excitement, pulse being only 60, but somewhat wiry; free evacuation from the enema last evening; another enema ordered; diet light.

11th. Passed the night well; feels comfortably; swelling of the face less; and complains of nothing but a stoppage of the nostril,

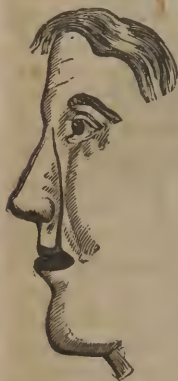
caused by a slight oozing of blood; pulse 62; bowels have been naturally moved; allowed to take any light nutriment.

12th. Symptoms as yesterday.

13th. Feels comfortable in every way; swelling of face disappearing; appetite good; has slept well during the night; pulse 64; bowels free.

17th. Pulse 64; appearance in all respects greatly improved; tumefaction of the face has very much subsided; removed the dressings, and took away the sutures; wound entirely healed by adhesion, except at the points, where the ligatures remain; reapplied short strips of adhesive plaster.

(Fig. 2.)



22d. Removed the plaster, and pulled away three ligatures. The patient feels desirous to go out, and expresses great gratification at his entire freedom of breathing, and rapid progress towards recovery.

May 29th, 1842. There is no appearance of any return of the disease, and the patient enjoys better health than he has done for ten years, and works at his trade.

The accompanying figure (Fig. 2) is an accurate likeness of the patient, taken from the life; and the line of the cicatrix in the soft parts, as exhibited at the present time, July, 1842.

No V.—EXSECTION AND DISARTICULATION OF THE ENTIRE HALF OF THE LOWER JAW, by Dr. MOTT, at New York, *Saturday, Nov. 23, 1844.* (Drawn up by P. S. TOWNSEND, M. D.)

The only notice of this case which has appeared in print, being the brief account contained in Dr. Mott's letter to M. Velpeau, (in Dr. M.'s Preface to the 1st vol. of this work,) I subjoin the following memorandum, which I made at the time of the operation, taken down from what I was an eye-witness to, and read to and approved of and corrected by Dr. Mott.

The operation was performed between 1½ and 2½ P. M., Saturday, Nov. 23, 1844. The patient, a young gentleman by the name of *William Edgar Baker*, native of, and clerk in a respectable mercantile firm in, this city, and aged 25 years, was stout, of rather thick set frame, full sanguine temperament, florid full face, broad neck and chest, but dark hair and eyes, and altogether inclined to embonpoint.

About a year since his uncle (present in the room after the operation) told me Mr. Baker complained of pain in the right side of the lower jaw which soon began to swell and so continued until it reached its present magnitude—being apparently a uniform enlargement of the whole of the middle part of the base of the jaw on that side which, with the induration of the superincumbent tissues, periosteum, aponeurosis, fasciæ and muscles, give it to the eye and feel the form of a spindle-shaped, hard, consolidated, and apparently

almost boney or semi-cartilaginous tumor throughout, perfectly unyielding to pressure, and about *three inches* through in its transverse diameter, or that through its middle, and *five to six inches* in its longitudinal diameter or that in a line with the base of the jaw, tapering each way as it reaches the angle of the jaw at one end and near the symphysis of the chin at the other.

Dr. Mott, the first surgeon who accurately described and attempted the formidable operation of exsection of a part or of the whole half or more of the lower jaw as the remedy for this insidious and formidable disease, and who pronounced this case to be one of the same kind as the twelve to fifteen others for which he has operated upon during the last *twenty-six years*, denominates it *osteo-sarcoma*, which left to itself terminates in a malignant morbid growth of the osseous and other structures implicated, finally resolving itself into an open carcinomatous ulceration, caries, and destruction of the parts.

He does not pretend to assign any particular cause for this malady. In the present case the uncle told me young Baker had, as indeed his whole appearance, complexion, frame, &c., indicated, enjoyed the most perfect and robust health from his infancy. He had never known him in fact to have suffered from any disease, and he had never had any affection whatever, except that some months back he had been attacked with a slight *erysipelatous inflammation* in one of his legs—I think he said in the calf, which, however, soon subsided without ending in suppuration or ulceration as one might have imagined it would have done, as a natural drain in a person like this patient evidently inclined to a rather gross and plethoric habit.

I asked him particularly if the erysipelas had ever attacked his face and head in the form of *St. Anthony's fire* as I could readily conceive that in the form of *angioleucite*, involving, as it does, the thick, muscular, and aponeurotic and periosteal tissues and the bones themselves at the base of the cranium, causing distressing pain and tension of those parts, this serious variety of erysipelas (so well described by M. Velpeau in Vol. I. of this work) might result, especially when abundant sanguineous and cathartic depletion had not been made use of, in precisely such a disease as this *osteo-sarcoma*.

But this patient had also been particularly abstemious and temperate, though not (his uncle said) a teetotaler, or not at least as to food. It was very evident that he had not much stinted himself in good eating. There may be something of *hereditary* taint in this case, as the father had been operated upon also for an *osteo-sarcoma* of the upper jaw some years since.

First Stage.—In all those severe cases requiring extensive exsection of the lower jaw, Dr. Mott has laid it down as a principle, (See our Notes to Velpeau's Operative Surgery, Vol. I.) to take up the primitive carotid as a preliminary and indispensable step, in order to cut off the dangerous hemorrhage which would otherwise ensue from its principal branches.

Accordingly, he proceeded to apply a ligature upon this vessel, an operation in which he is so practised, (this making, I think, the

22nd time of his applying it,) and which at the time he first performed it in this country was in itself deemed one of very considerable importance, but now, as is seen, made by him who *first* projected it as indispensable in the exsection of the lower jaw, a mere appendage to this operation and one of very subordinate character.

With great rapidity of manipulation, he made at once with the convex-edged scalpel (convex bistoury, as the French call it) a deep incision of about *two and a half inches* long, entirely through the whole thickness of the integuments, platysma myoides and cellular tissue, and which was so neat, perfect and complete in itself that it immediately exposed the entire aponeurosis of the inner edge of the sterno-cleido-mastoid muscle close and parallel to which inner edge and comprising nearly the whole of the region of the middle third of that muscle, this incision had been made.

As soon as this was made by Dr. Mott, a few movements of the blunt flat handle of the scalpel quickly separated the tissues so as to reach the sheath of the primitive carotid, under which in a few moments more he insinuated the American blunt artery hook armed through the eye at the extremity where it is screwed on to the stem of the instrument, with a strong twisted double silk ligature. As soon as the blunt end of the hook could be made to work its way through the connecting fibro-cellular tissues so as to be felt and seen on the inner side of and close to the artery, the surgeon unscrewed this curved portion from the stem by some few turns of the handle, and then drew the curved portion out, leaving the artery above the ligature clearly identifying the vessel by its size, pearly color and distinct strong pulsations, and after ascertaining that it was cleanly separated from its attachments, it was firmly tied and the threads left uncut.

This preliminary operation consumed only about *fifteen minutes*. The patient was then allowed to rest awhile—not however longer than ten or fifteen minutes more, which could scarcely be called a *stage* or *premier temps*, though I have for convenience so denominated it.

Second Stage.—The surgeon now proceeded to the principal operation, the first step of which consisted in the *free, bold, curvilinear incision*, which as the tumor was on the right side, was made with the left hand. This curvilinear incision he was the first to project in these operations upon the lower jaw, as he was the first to project the operation itself of exsection of this jaw for osteo-sarcoma.

This incision, which was of great length, commenced at the jugum, in front of, and about opposite to, the meatus auditorius externus, It was then carried downwards over the most bulging part of the tumor behind the angle of the jaw, and thence continued along the lower part of the tumor, in a semicircular direction, was brought suddenly upwards by a short curve, and terminated upon the chin, within an inch of the margin of the lower lip, so as to open into the mouth, opposite the incisor tooth adjoining the cuspidatus—and so as to preserve completely and leave intact the

commissure of the mouth. This incision is the one which Dr. Mott adopted, in his very *first case of exsection* of the lower jaw, in a young lady of this city, in 1821, (See *supra*,) and one great object he then had in view was to save the face on the agglutination of the borders of the wound, as much as possible from deformity; which it effectually did, besides being by far the best kind of incision for these cases, as the *convex* border when freely dissected upwards, forms thereby a flap of a semicircular and oval shape, which when cicatrization takes place conceals the line of the wound below the base of the jaw. This flap also by being turned up during the operation is out of the way, and gives a more ready access to the subsequent steps of the operation. The shape of the whole incision in this case was as near as could be, that of a long blunt hook,* lying obliquely downward and inward, *i. e.*, diagonally on the side of the neck, with its curve, the longest portion corresponding to the straight stem of the instrument, and the shorter or more curved portion in front, constituting more properly the hook itself. Without the least delay the surgeon now proceeded to dissect the flap upwards until finally it was detached from the tumor above. This opened into the cavity of the mouth and laid bare the masseter muscle. The next step was carefully to determine the extent of the tumor forward upon the chin. This being ascertained, by dissecting the soft parts from the chin a little way until the bone appeared sound, the incisor next the cuspidatus was extracted. Room was next made by detaching the soft parts below the base of the jaw, near the chin, and from within the mouth, so as to enable a probe to be introduced from within the mouth, and brought out below, by which a chain-saw was introduced below the bone, and the jaw sawed through from below upwards. The tumor was now dissected along the side of the tongue and from the pharynx. As the dissection progressed, the masseter was carefully detached from above the tumor, where it was sound, so as to preserve this sound and upper portion of the muscle, the lower part where it was attached to the tumor, being in a diseased state and of course removed with that mass. The exsected end of the divided diseased bone in front, afforded an excellent purchase for the hand, and the surgeon after resting, (at the request of the patient,) a few moments, proceeded to detach completely all the remaining adhesions of the sound portions of the tissues and connections both above and below and as near the jaw as could conveniently be done, without leaving unremoved any of the degenerated structure. This diseased mass was thus isolated as perfectly as possible.

A number of arterial branches were here necessarily divided, and the hemorrhage in consequence exceedingly profuse, notwithstanding the ligature on the primitive carotid. Dr. Mott, in reflecting upon this curious phenomenon, and the one not perhaps less so, that in two cases where he rested 24 hours between

* Mounting upward at the termination of its point near the lip.

the tying of the carotid and the exsection of the bone, he found comparatively speaking, no hemorrhage whatever, considers that the first could be in part explained in this manner. When the operator after the ligature on the carotid, as in this case, proceeds at once to the dissection and exsection of the bone from its connections, the *distal portions* of the cut branches of the primitive carotid not having had time to contract or collapse, as it were, are yet loaded with blood, from the great vascularity of this neighborhood, and the current which has been for so long a time setting into and upon the diseased growth. They therefore still retain their abnormal diseased calibres, several of them in fact which would scarcely be noticed, if they possessed only their normal size, appearing as in this patient to have attained the diameter of a *crow-quill*, as for example, a branch of the internal maxillary, and one that a surgeon who was present thought, (erroneously however Dr. Mott thinks,) a branch of the superior thyroid.

The consequence is, that on dividing these branches and ramuscles there spouts from them a strong, forcible, and continued stream, but not *per saltum*, as from other arterial vessels, because the *vis a tergo*, in consequence of the ligature on the primitive trunk, is now cut off. This steady, powerful, and voluminous stream, which in several spurted with great force to the distance of 6 or 8 feet, spattering to a considerable extent the operator and his assistants, is calculated to excite considerable surprise at first. Dr. Mott's explanation is this, that the cut branches are acting not only under a certain portion of their inherent and natural contractile power, but under that of a reflux *venous current into them*. Whereas, when an interval of 24 hours has taken place after the ligature has been placed upon the carotid, its distal branches, *i. e.*, those above the point of arrestation of the blood have had time to contract in proportion as the blood in those channels gradually passes from them into their corresponding veins, in its onward course to the heart. The calibres have then, as it were, time to be effaced by the natural systole of the artery, the walls themselves of the vessel probably (as some late experiments would prove,) becoming partially agglutinated by the exudation of a plastic lymph.

We think this explanation both plausible and philosophical. Yet Dr. Mott prefers to proceed at once to the exsection, immediately after the ligature on the artery, because it makes one operation, and therefore avoids the increased danger of a double operation, and because it is better to accomplish the object in view at once, if the nervous system will admit of it. In four cases however, Dr. Mott says he has tied the carotid on one day, and on the next, removed the jaw, and in the greater number of cases he has performed both operations on the *same day*. He is well satisfied that the hemorrhage is less when the artery has been secured the day before the bone is removed.

Having left the isolation of the coronoid and coracoid processes of the jaw and the disarticulation of the jaw itself as the last step in this formidable operation, the surgeon, from the loss of blood

and the necessarily painful nature of the extensive dissections that had been made, (though this singularly heroic youth, as all remarked, scarcely ever winced, or moved, or twitched a fibre of his face or uttered even a sigh,) thought it best now to rest for a few minutes.

Third Stage.—Some 15 to 20 different vessels having been now tied, in the course of the operation, and one of the lymphatic glands having been wholly removed, and the parotid divided in its whole length where the commencing extremity of the incision had passed over it, Dr. Mott proceeded with great caution and firmness to separate the extremity of the coronoid process from the close attachment of the fibres of the temporal muscle inserted upon it, and finally completely unbridling it from beneath the zygoma, reached in the same manner by a firm, steady and rapid dissection close to the surface of the bone, the neck, and finally the articulating surface of the condyloid process and that of its socket, the glenoid cavity, immediately in front of the meatus externus of the ear, in doing which he was particular to carry the knife close to the bone, until he reached the articulation. This may be considered an important step to be observed by every operator, in order to avoid wounding the internal maxillary artery. In the course of these dissections the trunk of the portio dura nerve was also necessarily divided as well as many smaller nerves and vessels.

In separating the branches of the lower jaw from its connections about the temporal bone, it may easily be conceived that not only considerable strength in the fingers and knife are required, but also great care in the movement of the instrument, for even when held as flatwise and close as possible to the surface of the bone from which the firm fibrous and periosteal adhesions are being detached, it would be a very easy thing for its edge to sever by some slight slip of the blade, some of the important vascular and nervous trunks in the immediate neighborhood, as for example, the internal maxillary, as just stated.

It is a singular fact that the only time at which I could observe that this patient, (whose cool moral courage astonished all present,) uttered an audible moan was on placing the ligature upon the inferior dental artery. The pain must have arisen from comprising some small filament of nerve in the ligature, though care had been taken to exclude the inferior maxillary nerve from the ligature. As soon as the operator had reached the articulation of the jaw the capsule of the joint was speedily divided, and the whole bone down to its exsected extremity instantly removed, together with all the diseased tissues upon it. The patient now presented in truth a frightful appearance, yet he was calm, still and collected through the whole of this trying scene. Nor can we suppose that the wine or brandy and water which he occasionally took during the operation, and which had now lasted over an hour, had contributed to give him any artificial power of enduring such agony of pain as he must have felt, with such unparalleled sang froid and serenity. Before the operation in fact, he took only 20 drops of Magendie's

solution of morphine, and a very little wine and water. He was fully conscious and sensible through the whole of it, and until the enormous cavity and destruction of parts was made in the side of his face and head, appearing like some terrible wound, or as if the operator had been dissecting a human being alive and cutting his throat, he continued to talk composedly, and to reply with the utmost coolness possible to every question put to him. The appearances now it would be difficult for any but an artist to depict.

The enormous wound, exposing the tongue, upper-jaw and fauces and right side of the throat up to the styloid process of the temporal bone, was now thoroughly sponged out with warm water, and a thin compress wet with warm water, and of sufficient size, placed over the raw surface, and the flap brought down nearly upon it, while warm dry cloths were gently applied outside over the whole; all which was judiciously done by the operator, in order to know the worst of any concealed hemorrhage, and to encourage it to appear, so that it would not afterwards be necessary to cut the ligatures and re-open the wound after the sutures had been some hours inserted.

In about half an hour, as there appeared to be no exudation of blood whatever, the flap, after being held up a short time, was brought down and neatly adjusted to the lower border of the incision and fastened accurately in its proper position, especially below the vermilion border of the lip, by a sufficient number (in all some 6 or 8) points of interrupted suture. When the whole was properly placed in coaptation, the general contour of the face seemed now so natural in size and form, and the line of the wound was so little visible, that one could scarcely realize that there existed so much havoc and destruction of parts beneath.

The incision upon the carotid was also brought together in the same manner by two or three sutures, and the patient let to remain on the table upon which he had been bolstered up, and where he had been operated upon. Being now, as was to be expected, somewhat pallid and languid, and the pulse greatly reduced in frequency and force, though there was no actual syncope, this was met by a more liberal use of warm wine and water. But he exhibited constantly the same imperturbable calm and resolution which he had during the operation; because he believed, as he said before the operator began, and when he took leave of some of his young friends the day before, upon a higher power than man. It was this serene christian faith and resignation which was the true secret of his incomparable and heroic courage. I have seen such demonstrations, but none of so high an order, on the dying couch, from the same blessed consolation, which none but those who have imparted to them this priceless boon, and through divine grace, can realize or enjoy. And I have often said, that if any thing were wanting to convince me of the power of religion on the heart, and of the constant supervision of the divine Creator over human actions, and the link between Him and the immortality of the soul, it would be these sublime moral spectacles in the hour of overwhelming tribulation and unutterable anguish, and when reliance, and hope alone

in our Almighty Father, can disarm death and every mortal sorrow of their sting, and make us triumph over every worldly desire and the grave itself.

This patient recovered perfectly in a few weeks, nearly the whole wound having healed by the first intention.

P. S. TOWNSEND, M.D.

[In connection with the subject of Dr. Mott's exclusive claims, as the first surgeon who ever exsected the lower jaw for *osteo-sarcoma*, we here subjoin his recent letter to Mr. Liston of London, (See *New York Journal of Medicine*, No. 15, Vol. V., November, 1845, p. 413, 414.)

Letter from Prof. Mott to Dr. Liston, of London.

TO ROBERT LISTON, F.R.S., Prof., &c.

My dear Sir,—The great object in all our investigations ought to be truth. In no profession is it more important than in the healing art. Our noble profession, if exercised upon this basis, becomes an ornament and a blessing to our race.

From the distinguished position you are in, and the thousands who listen to your admirable lessons, and witness the skilful movements of your knife in surgical operations, your opinion of a point of practice, or the author of an operation, will be powerful and lasting.

You are in common with all men tenacious of your own rights, and I cheerfully believe will magnanimously award what is just and right to others. I appeal to you therefore as a professional friend, to weigh me in the balance of justice, and I shall have great pleasure in awaiting your decision.

I claim for myself and for my country *originality* in the operation of exsection of the lower jaw at the temporo-maxillary articulation, and in different proportions for *osteo-sarcoma*. I avow and declare solemnly, that [before my first exsection of the lower jaw for *osteo-sarcoma*] I never saw, read, or heard of anything of the kind ever having been done in any country. There are surgeons now living in this city who saw my first operation, and all of them will cheerfully testify to the truth of what I assert.

Far be it from me to presume to say that other surgeons may not have thought of the same expedient, and since executed the same operation without the least knowledge of what had been done by me; of one thing, however, I am certain, that an eminent surgeon now in Paris, informed me that he took the printed sheets of my first case with him to Paris and told M. Dupuytren of them; he (Dupuytren) requested a translation to be made, stating, that in a few days he would give a clinique on that subject. The translation was made by my friend and handed to Dupuytren. He gave his lecture with my case in his hand, but made no allusion to it. My firm belief therefore is, that my operation for *osteo-sarcoma* was performed before those of this eminent surgeon [for that affection.]

Some two or three years after the publication of my first case, I read an account of several cases which were operated upon by my

friend Dr. Cusack, of Dublin. Knowing as I do personally that distinguished surgeon, it never occurred to me to say anything in relation to this subject in all our intercourse in Dublin and Paris. From whom he derived the idea, therefore, I know not; it may also have been original with him. This, however, can only be answered by Dr. Cusack himself. As you have stated in your lectures published in the *Lancet*, that Dr. Cusack was the *first* to perform the operation of exsection of the lower jaw for osteo-sarcoma, I have felt constrained to make to you this statement in justice to myself.

My first operation was performed on the 17th November, 1821, and is published at length with plates in the "New York Medical and Physical Journal," vol. I., p. 385.

Since that period I have performed the operation *seventeen times*. In three instances the bone was removed at the temporo-maxillary articulation. In one of the cases, the bone was sawed through at the first bicuspid tooth of the opposite side.*

All surgeons of reading or observation must be aware that from time immemorial, either large portions or even the totality of the lower jaw have been removed or destroyed by violence, various accidents, and in later times by gun-shot wounds, fire-arms, &c. It has also long been familiarly known that partial or total destruction of the lower jaw has been spontaneously produced by the morbid processes of caries, necrosis, &c. Thus nature herself, in these latter cases particularly, pointing out as it were to the surgeon, from the perfect restoration to health that has succeeded to such disasters, that he himself might venture to follow in her footsteps.

For the great historical details, we refer to Velpeau's *Operative Surgery*, vol. III., Paris edition, 1839.

But lastly, we repeat and aver, that the exsection of the lower jaw of even a fourth part, much less a half or two-thirds of it, for any form of sarcoma involving the whole texture of the bone, has never in our opinion been performed by any surgeon, past or present, until by myself at the time above stated.

The *onus probandi* that my claims are unfounded rests with others. For my part, I know of no record in existence now, nor did I know of any at the time I performed the operation, as I have already said, which can in the slightest degree militate against my pretensions.

Even admitting that M. Dupuytren did exsect a portion of the lower jaw, prior to myself, it is conceded by Velpeau, who pronounces his operation altogether *new*, and a *great triumph* in surgery, that it was performed for cancer and not for osteo-sarcoma.

Indeed we find that so eminent an authority as M. Ribes (*Dict. des Sciences Médicales*, tome XXIX., page 431, Paris edition) also positively asserts upon the testimony of M. Lisfranc, who assisted at and published an account of the above operation of M. Dupuytren in 1812, that it was a *cancerous degeneration*; and to show furthermore that M. Ribes himself so considered it, he, in his pre-

* See this case, with plates above, being that of the negro *Prince*.

liminary observations on the lower jaw in the same work, speaks in the following *prophetic* language, in reference to the pleasing anticipation that this exsection for cancer would ultimately pave the way for a similar operation for the cure of that hitherto intractable and fatal malady, osteo-sarcoma. His words are as follows: "These facts lead to the hope that fungus, or *osteo-sarcoma* of the lower jaw, a disease so formidable, that it has in many cases been vainly attacked with the iron and fire, will *henceforward since the operation performed by M. Dupuytren be removed by amputation of a portion more or less considerable of the lower jaw*, without the danger of any accident, and *if the disease is local, with a certainty of success.*"

We are also aware that M. Bégin's (*Dict. de Méd. et de Chir. Pratique*, Paris, 1835, Vol. XIV., p. 259) states that Dr. Fischer appears to be one among the first who has performed the exsection of the inferior maxillary bone at the temporo-maxillary articulation. His operation dates in the year 1795, and furthermore, M. Bégin remarks (*Ibid.*) that he has been successively imitated by Mursinna, Graefe, Mott, Dzondi, McClellan, Liston, Jaeger, Dupuytren, Walther de Bonn, and MM. Gensoul and Lisfranc.

So far as the *disarticulation* of this bone is concerned, M. Velpeau (the most accurate living authority in relation to the history of surgery) distinctly asserts that M. Palmi was the first individual who first disarticulated the lower jaw.

For ourselves we can assert, that without attempting to *imitate* any of our predecessors, the disarticulation of the lower jaw, where we have resorted to this, has been performed by us purely in reference to the exigencies of the case as presented while exsecting this bone for osteo-sarcoma, and that we claim priority and originality both for the exsection for osteo-sarcoma, as well as for the single curvilinear incision below the base of the jaw, by which the operation is accomplished.

With considerations of the highest respect,

Believe me to be, truly your friend,

VALENTINE MOTT.*

NEW YORK, Sept. 30, 1845.

Another case of *exsection* by Dr. Mott, viz., that of the ends of an ununited fracture of the *os brachii*, will be found above, under the head of *Ununited Fractures*—Exsections.

To these are to be added for years past various other exsections, almost invariably with a happy issue, of portions both of the *upper and lower jaws*, their *dental borders*, &c., &c., which he has not deemed of sufficient importance to publish the details of. T.]

* Dr. W. H. Deadrich, of Athens, Tennessee, published in the sixth volume of the "American Medical Recorder" for 1823, an account of an operation by which he removed the lower jaw from the angle to the centre of the chin, for a large cartilaginous tumor, which occasioned great difficulty in swallowing and breathing. The patient was a lad fourteen years old, and the operation was performed in 1810. This boy had a speedy recovery. This was made public two years after the publication of my first operation.—V. M.

SECTION XI.

TREPHINING OR OPERATION WITH THE TREPHINE.

Trephining (la trépanation) appears to have been practised from the remotest antiquity. Its origin is lost in the night of time. It is performed on almost all the bones of the body, more particularly in connection with their exsection; but more especially upon the bones of the cranium.

CHAPTER I.

THE HEAD.

ARTICLE I.—THE CRANIUM.

Trephining, notwithstanding the improvements which it had received from the physicians of ancient Greece, and its relinquishment in the middle age to that species of charlatans whom Sylvaticus denominates *circulatores*, is one of those operations which, since the time of Guy de Chauliac, have more especially occupied the attention of surgeons. For a long time it was believed to be the principal and only remedy for accidents which supervene from blows, falls, and most of the traumatic lesions of the head. Panaroli and F. de Hilden (Bonet, *Corps de Méd.*, t. II., p. 374) trephine for a simple chronic cephalalgia, and Marchettis for epilepsy. M. A. Séverin, who formally advises trephining in this last case, is sustained by the example of Sala. Boucher, De La Motte, M. Dudley, and M. Unger, (*Encyclogr. des Sc. Méd.*, 1838, p. 171,) a surgeon of Château-du-Loir, whom I saw operate in 1813, have since done the same thing. MM. Guild (*Rév. Méd.*, 1829, t. IV., p. 301) and Warren, (Communicated by the author, 1837,) in these latter times, assert that they have also each performed this operation with success [for epilepsy.] The epilepsy, however, reappeared in the young man operated upon by M. de Renzi, (*Il filiatre sebezio*, Oct., 1837.) A wound in the sinciput was followed by vertigo and paralysis; Scultetus (*Arsén. de Chir.*, p. 23, obs., 13. *Dict. des Sc. Méd.*, t. I., p. 15) applied two crowns of the trephine at the expiration of nearly two hundred days, and cured his patient. A man mentioned by Wepfer, caused his cranium to be perforated with a *wimble* (vile-brequin) by a blacksmith, who thus cured him of an ancient cephalalgia! Fractures of the internal table of the bones, which Garengeot has so often spoken of, and attrition and simple contusion of

the diploe, have also been ranged among the cases which require the employment of the trephine; but we must take care not to go too far in such cases. M. Ramsden, who ventured to perforate the frontal bone for a simple supra-orbital pain, saw his patient die on the fourth day from meningitis, and I could easily cite other similar unfortunate cases. What I have said of exsection of the cranium renders it unnecessary for me to treat at length of the trephine, the more so as I have elsewhere (*De l'Opér. du Trépan dans les Plaies de la Tête*, etc., 1834) considered all that appertains to this last-mentioned operation.

§ I.—*Indications.*

The object of the trephine is to give egress to the foreign liquids which may have become effused in the cavity of the cranium, to allow of the removal of splinters which have penetrated into the brain, and the extraction of any extraneous body whose presence might interfere with the cerebral functions.

A. *Fractures*.—Nothing is more vague than the signs by means of which authors pretend to recognize the various lesions which require trephining. The sound of a cracked pot and perforated at the moment of its fall, or that which is emitted by bones when they are struck by a small stick, as mentioned by Laufrenc, are altogether insignificant. It is the same with the inclination of certain patients to carry the hand mechanically to some determinate point of the cranium; the concussion (*ébranlement*) experienced by others at the moment when a piece of linen which they compress between their teeth is suddenly snatched from their mouth; and the painful sensation they experience in making a long inspiration, and upon which Roger, of Parma, has so much insisted. All those signs may fail though there exists a fracture, and on the contrary, may be present in lesions infinitely more unimportant. Besides, it is not the fracture properly so called, but rather the compression which it has caused, which should justify the operation of the trephine.

B. The presence of *effusions*, whether sanguineous or purulent, is also equally difficult to ascertain. We may especially find it extremely embarrassing to identify their situation. Sometimes it is immediately underneath the point injured that they are formed, sometimes at the point diametrically opposite, and frequently also at a less remote distance from this point. The paralysis which indicates that the injury is situated on the opposite side of the cranium, may be found to be on the corresponding side, (Bayle, *Rév. Méd.*) If the integuments of the cranium are not altered; if no contusion or division is observed there, it is almost impossible to determine (*prévoir*) within half an inch, and often within several inches, what is the precise locality of the effusion, (collection.) The application of a cataplasm over the whole head, as recommended by the ancients in order to ascertain which part of this topical application should become dry the soonest, and which would corres-

pond to the part diseased, is a puerile resource, the exact value of which has long since been properly appreciated.

C. On the other hand, as it has been found that *collections* (foyers,) though they were considerable, have been absorbed (se dissipent) without trephining; as fractures with depression (l'enfoncement) of near an inch, a case of which kind has been related respectively by M. Jannin, (*Bull. de la Fac. de Méd.*, t. VI., p. 498-509.) Physick, MM. Horner, Paillard, Graefe, Ribes, &c., have, nevertheless, not prevented certain patients from recovering without an operation, Desault and his school, contesting the doctrine of the ancients, and of Garengeot, J. L. Petit, De Quesnay, Pott, and the entire Academy of Surgery, and falling back upon the ideas of Van Wyck, Aitken, and Metzger, have with good reason established as a general position, that the operation of the trephine is rarely necessary, and often injurious, and that we ought in consequence to dispense with it, in a great number of cases where the surgeons of the last century recommend it. This doctrine, which is sustained by the researches of Briot, and which is advocated by Professor Graefe, at Berlin, and adopted by the English surgeons, has generally prevailed in France, where it has found a zealous, in fact, an extravagant (exagéré) champion in M. Gama.

D. Some respectable (recommandables) practitioners, however, M. Larrey, M. Roux, Dupuytren, Delpech and others, have on several occasions used the trephine with success at the Hospital of the Garde Royale, La Charité, and the Hôtel Dieu of Paris. Béc-lard and M. P. Dubois were not less fortunate in a case of fracture without displacement, though they had been obliged to apply three crowns of the trephine on the temporal fossa, and to extract nearly eight ounces of blood furnished by the middle meningeal (sphéno-épineuse) artery. M. Toussaint, in 1825, published a similar success which he obtained by means of six crowns [*i. e.*, six applications] of the trephine, and I have elsewhere shown (*Opérat. du Trépan dans les Plaies de Tête*, etc., 1834) the little value [to be attached to] of most of the arguments invoked against the trephine by its most zealous opponents.

Thus without being as prodigal in the use of the trephine, as was the custom before the time of Desault, and without absolutely admitting with MM. Foville and Flourens, that it may be useful in protecting the organ from compression in the inflammatory and other fluxions of the encephalon, it appears at least, that it ought to be had recourse to more frequently than it actually is at present. If it be true, that we are often embarrassed in recognising the seat and nature of the diseases which indicate it, it is not the less so, that in some cases the difficulty (chose) is not placed beyond the reach of an intelligent practitioner. Moreover the patients, when it is decided upon to employ it, are in so alarming a state, that a simple perforation of the cranium cannot add much to the dangers with which they are threatened. If then we should have become positively assured by any means whatever, that a foreign body, splinter, angle of bone, or extravasation of fluids (dépôt de liquides,)

are the cause of the unpleasant symptoms noticed, then ought we to trephine; the same must be done for those effusions, ancient or consecutive, which are announced by the necrosis of the bones, the separation of the pericranium, the dark color of the surrounding tissues, the pale aspect of the lips of the wound, the crepitation of the integuments of the cranium, &c.

A sailor received a blow on the head, which was followed by fracture of the cranium and compression of the brain. The trephine was employed, and the patient was cured, (Filleul, *Gaz. Méd.*, 1833, p. 47.) A depression of the cranium kept up a paralysis. M. Warren (communicated by the author, 1837,) had recourse to the trephine, and cured his patient. A lock of hair which had got folded back upon the dura-mater, during the accident, afterwards became firmly imprisoned (*étranglée*,) between the edges of the fracture. As no cerebral accidents had supervened I waited: symptoms of compression and meningitis now came on. The trephine was used but the inflammation continuing unsubdued, death ensued. I would have operated sooner, had not M. Rey, (*Thèse* No. 79, Paris, 1834, p. 99,) in a similar case seen a cure take place after the formation of a sequestrum.

§ II.—*The parts of the Cranium which admit of the application of the Trephine.*

The operation being once decided upon, another question presents itself: upon what region should the instrument be applied? It was formerly established, that the trephine should not be applied above a *horizontal line* which would separate the base from the vault of the cranium, by passing near the *nasal process* [of the temporal bone,] (*bosse nasale*,) and on the external *occipital protuberance*; nor upon the sutures, nor track of the *sinuses* of the dura mater, or *frontal sinuses*, nor on the *temporal fossa*, *antero-inferior angle* of the parietal bone, &c. Notwithstanding which, Béranger de Carpi, Cortesius, Hoffman, Bromfield, and Pallas, have trephined opposite the sutures with entire success; while Acrel, Wurm and many others have perforated the frontal sinuses with good results. We shall moreover find (under Tumors of the frontal sinus) that the trephine is frequently required for the peculiar diseases of those cavities. Warner, Marchettis, Garengot, Sharp, Pott, Callisen, Mosque and Lassus, have laid open different sinuses of the dura-mater, without anything unpleasant resulting, and the experiments of M. Flourens on animals, go to prove that this may be done almost without any inconvenience being thereby produced. [See Remarks of Dr. Mott on this subject, Vol. I.]

Carcano, and Job à Meckren, had already had the boldness to trephine upon the temporal fossa, without regarding the lesion of the fibres of the temporal muscle, while Bilguer, Copland, Gooch, Abernethy, Hutchison, and Giersh, have laid bare the brain in perforating the occipital bone. When we apply the trephine upon the sutures, either the body to be extracted is found immediately

underneath, and then their adhesions have necessarily been destroyed, or the seat of the difficulty is not there, and then the operation should be performed upon another point.

M. Larrey, Boyer, M. S. Cooper, and C. Bell, have remarked, that upon the frontal sinuses, we shall be enabled to avoid wounding the membranes, by commencing the operation with a crown larger than the one that we are to terminate with. Moreover what danger would there be in wounding the dura mater? When we open into the venous sinuses of the cranium, the hemorrhage which was so much dreaded by the ancients, generally ceases of itself, or at least by means of simple tamponing. [See remarks of Dr. Mott, *supra*, on wounds of the sinuses of the brain, Vol. I., and on hemorrhage of large arterial trunks in this Vol. II. T.] On the external occipital protuberance there exist no other arterial branches of any considerable importance except those of the occipital; and the lesion of the trapezius, or complexus muscles which are attached to these protuberances, can be of no consequence. In the temporal fossa, the section of the muscle, in whatever way it may be effected, interferes in no wise with the restoration of its functions. As to the wounding of the meningeal artery it could easily be remedied, by means of a pledget (bourdonnet) of lint drawn from the interior to the exterior of the cranium by means of a double thread to be fastened outside upon another pledget, as was done by Physick, or by means of cauterization with a probe heated to a white heat as practised by M. Larrey, or by a plug of cork pierced in its centre, or by a piece of wax, or a plate of lead bent in such manner as to compress the two sides of the bone and the furrow which contains the artery, to which vessel a ligature was on one occasion successfully applied by Dorsey of Maryland.

Sabatier, reviving the precept of Lanfranc, recommends placing the crowns of the trephine near the depending point of the extravasation. As it is almost always practicable by changing the position of the patient, to incline the opening into the cranium downwards; as we more frequently have recourse to the operation in order to extract a foreign solid body, than to give issue to liquid matters; and as it is rare that the effusion (foyer) has any considerable extent, this precept is less important in practice than might be at first imagined.

§ III.—*Dressing.*

Hippocrates speaks of a rasp known under the name of *xistre*, with which he scraped the bones, that he might thin them, or recognise their cracks, (*fêlures*.) His trephine was a sort of gimlet, (*fôret*) acting in the manner of a drill, (*vrille*.) He speaks however, of another also, which must have had some analogy to the crown-piece which was described at a later period. Celsus gives to this crown the name of *modiolus*; without doubt says Guy de Chauliac, because it resembled a small wine *measure*, (*un petit muid*.) He compares the trephine, properly so called, to

the carpenter's auger. Galen is the first, who speaks of *abaptistes* trephines, *i. e.*, with crowns or perforators, provided with a border or sheath, which prevents them from penetrating too deeply. These *abaptistes* which are found mentioned in the Works of Lanfranc, and of a great number of other surgeons, have been long since proscribed from practice. A lenticular knife, the gouge and chisel, as well as the *méningo-philax*, a sort of stem terminated by a flattened button, and used for inserting the pledget of lint, (sindon,) between the dura mater and the bones at the time of the dressing, had been already employed in the time of Heliodorus and Galen. We find, moreover in the work of André de Lacroix, cutting pliers, (tenailles incisives,) screw-rings, (tire-fonds,) and elevators, as well as the suggestion of the famous triploid, (triploide,) recommended by Scultetus, and the disadvantages of which J. L. Petit took particular pains to point out.

The articles used now, and which are usually contained in what is called a *trephine case*, are a trephine, properly so called, with its shaft (arbre) and crowns, a screw-ring, (tire-fond,) a central pin, and its key, various elevators, a lenticular knife, a chisel, cutting pliers, a crested saw, a small brush, and a leaden mallet. The trephine and demi-trephine, which the English and many German surgeons prefer, should also make a part of this case. At the present day, the osteotome-saw of M. Heine, and the turning-saw of M. Thall, could readily replace the ordinary trephine, if they were cheaper, or more easy to work with. I have described farther back the cases where we should have recourse more especially to the rowel-saws of MM. Martin and Charrière.

§ IV.—Operative Process.

The patient being in bed, and having his head resting upon a small pillow, beneath which should be placed a plate (planche) or large metallic vessel, is held in this position by the assistants.

A. *First Stage*.—The operator, provided with a straight, thick, and sharp bistoury, more or less dilates in different directions, the wound, should any exist. In the contrary case, an incision whose shape has undergone much variety, is made upon the integuments of the cranium, which have been previously shaved. Lanfranc, Guy de Chauliac, and Lassus, recommend that it should resemble a 7 reversed. V. Swieten prefers that it should have the form of an X, and that its flaps should be excised. In general, we employ the T or crucial incision.

When we operate on the temporal region, cotemporary authors, following Sabatier and M. Richerand, advise that it should have the form of a V, with its base above, since according to them, we divide in this manner a very small quantity of muscular fibres. I see nothing censurable in this mode, only that it appears to me that there is a delusion as to its advantages. If the apex of the V comprises a transverse section of the temporal muscle, of less extent

than its base, we nevertheless divide all the fibres included between the two extremities of this last.

It is now a long time since the circular and triangular incisions, and all those in which the flaps were extirpated, have been recommended by any one. Whatever Pott may say of it, the crucial, (*en croix*) incision is that which is preferred. For myself, I should prefer the semi-lunar incision, which allows of our raising up and letting fall the flap upon the cranium as everywhere else.

When we have no apprehensions of encountering fissures, the bistoury may be carried down to the bones with the first cut. The flaps being raised up, protected by fine linen, and held back by the fingers of an assistant, the next step recommended is to destroy the pericranium with a rasp. This is a useless, and even an injurious precaution. The pericranium in no wise interferes with the action of the trephine. The wounding it with the saw is not more dangerous than that which is made by tearing it with a rasp. In using the crown of the trephine at once, we lacerate it only on the circle which is necessary, whereas the rasp separates it always to a certain extent beyond that, which must evidently expose to necrosis; it would be better to divide it circularly with the point of the bistoury.

The vascular furrows even which had already been pointed out by Hippocrates, as calculated to lead to the mistake of the existence of a fracture, would not be effaced by it, (the rasp,) especially if they coincided with the abnormal depression of a frontal protuberance, and should present a certain depth, as I saw at La Pitié, in 1831. It would evidently afford no assistance in distinguishing from a true fracture, (*fracture*), the lateral suture, which is sometimes found on the parietal bone, the deviations of the sagittal suture mentioned by V. Swieten, Quesnay, Bontius, (*De Medicinâ Indorum*, obs. 10, p. 37,) and Manne, (*Obs. de Chir.*, etc., p. 205, 1729,) or the arrangement of the wormian bones, which came near deceiving Suncerotte. Nevertheless, if we desired to make use of this instrument, it would be necessary to grasp its handle with the right hand, and to embrace its shaft with the thumb and fore-finger of the left hand; then, by means of combined movements of the two hands, to manipulate with it in such manner as to prevent its slipping (*faire d'échappées*) or denuding the bones more than is desirable.

B. *Second Stage*.—When we make use of the *trephine*, (*tréphine*), of which M. Withusen has proclaimed himself the champion in Denmark, the surgeon embraces its handle with both hands and makes it act in the manner of a drill or cork-screw. If, on the contrary, the *trepan* (*trépan*) is preferred, its crown is adjusted upon it, after which the operator grasps its shaft with the right hand in the manner of a writing pen; directs the point of the centre-piece upon the centre of the portion of the bone which is to be removed; presses on the crown to mark this point, while the other hand supports the rest of the instrument; removes the crown immediately after; puts in

its place the perforating trepan, the apex of which is applied upon the point marked out by the centre-piece ; embraces by means of the thumb and finger of the left hand, united in a circle, the ebony plate which terminates the handle of the trepan ; presses on this plate by means of the chin or forehead ; seizes with the right hand the body of the shaft of the trepan ; causes it to turn two or three times from right to left ; refixes the crown in the place of the perforator ; reapplies the instrument as at first ; fixes its centre-piece in the hole which he has just made, and makes this immediately turn as before, while taking care to make pressure equally on all the teeth of the free border of the saw, in order to excavate a circular groove as regular as possible.

As soon as this groove is sufficiently deep to hinder the crown from escaping, the centre-piece should be removed : otherwise it would render the operation more tedious and dangerous. As it goes beyond the level of the crown, it would necessarily arrive upon the membranes before the section of the bones was completed. As soon as the trepan is again replaced in its first groove, the surgeon makes it act with rapidity while it is yet at a certain distance from the dura mater, withdraws it from time to time, to see if the section is made with regularity, and to cleanse its teeth with the brush, and also, as Hippocrates had remarked, to prevent it from becoming too much heated ; gradually afterwards relaxing its motion as soon as it traverses the layer of the diploe, the operator tries from time to time, by means of the elevator, to raise the osseous disc circumscribed by the crown, and finally ceases to act with the trepan when he hears a cracking sound, which it is impossible for those who have ever heard it, to mistake for any other, and which indicates that we have reached the membranes. The bones of the cranium were so thin in a child, says Peu, (*Pratig. des Accouch.*, p. 197,) that the trepan penetrated suddenly into the brain. In a patient, mentioned by Sellier, (*Bibl. Chir. du Nord*, p. 130,) the perforating trepan must have penetrated to 18 lines into the substance of the brain, without causing any accident ! The osseous plate, when it is completely divided, comes out sometimes at the same time with the crown. In the contrary case, we pry it out with the point of an elevator, which we use as a lever of the first kind.

C. *Third Stage.*—If the cut is smooth it is useless to employ other instruments to regulate the contour ; but as there are often found some points or sharp lamellæ at its deep-seated portion, it is the custom to apply the lenticular knife to these, the button attached to which is kept between the dura mater and the bones, in order to make its cutting edge pass round the entire circumference of the aperture which has been made. If we have reached the seat of the evil, the liquid matters begin to flow immediately. If it is a solid foreign body, we remove it with the forceps or any other appropriate instrument. Sometimes we perceive that the extravasation has extended to some distance beyond the point upon which we have operated. When it consists of coagulated blood or any other plastic material, a single crown is insufficient to give it exit ;

in that case we should not hesitate to apply a second or even a third. The destruction of a large portion of the vault of the cranium should not intimidate us when it seems indispensable. Solingen says, the Prince of Orange bore the application of the trephine seven times without inconvenience. Spigel relates a similar case. V. D. Viell speaks of a case in which the trephine was used twenty-seven times. Thus, as we have seen above, M. Toussaint effected a cure after the application of six crowns in a patient whose case he communicated to the Academy, as Cullerier, (communicated by the author to M. Champion,) had done in another. All the world, moreover, know the facts cited by Blégné, Saviard, and Lavauguyon, in which it is seen that almost the entire vault of the cranium was destroyed without causing death. A patient of Sand, (*Th. de Haller*, t. I., p. 97,) had in this manner an opening in his head of six inches circumference, and that of Vigaroux, (*Opusc. sur la Régén. des Os*, p. 127,) had lost the greatest portion of the frontal bone. Many Theses of Strasbourg contain facts not less remarkable.

D. *Fourth Stage*.—When many crowns are applied with the simple view of obtaining a large opening, it is no longer the usage to leave between them a species of bridges which were to be broken up by the strokes of the chisel, as was done by many surgeons of the middle age. We arrange them, since the time of Z. Platner, (*Institut. Chir.*, § 160, *et Hist. de Sprengel*,) in such manner that the circumference of one shall extend as close as possible upon that of the other, in order that nothing may rest between them but angles more or less salient, and which may be readily removed by the cutting-pliers. If we renew the perforation of the cranium, because the first has not fallen on the extravasation or foreign body, this is a second operation to be performed, and which must be conducted upon the principles laid down above. When the morbid collection is found immediately underneath the bones, nothing should induce us to divide the dura mater. But when the fluids are extravasated more deeply, we are no longer fearful since the time of Glandorp, of incising this membrane. We should not, however, do this except in cases where plausible grounds exist to assure us almost with certainty that we shall come down upon the seat of the difficulty, that is to say, where there exists a darkish, livid or yellow tint, and a protrusion more or less considerable of the external membrane.

This division is effected by means of a bistoury, the point of which is held perpendicularly to the extremity of one of the principal diameters of the osseous opening, in order to bring it to the other extremity without making it penetrate any deeper. The advice has also been given to incise the substance of the brain in cases where no fluid is found between the membranes. In support of this, authors cite a number of facts, among others a case observed in the practice of Dupuytren, who had the courage to plunge the bistoury more than an inch deep into the brain. In three lines farther, M. Bégin, who had already reached more

than an inch deep into the cerebral substance, would have fallen upon an enormous abscess! Such conduct, however, should be but very rarely imitated. When extravasation has its seat in the substance of the brain, how are we to know where it is to be found? Is it not in such cases, almost always the effect of an internal cause? By what sign should we recognize its presence, even though it should correspond to the opening of the bones? Doubtless a simple puncture of the brain, even though very deep, might not cause death, or even give rise to any thing more than slight accidents; but as the contrary is equally possible, it could never be without trepidation that the prudent surgeon, would decide upon dividing in this manner the substance of the encephalon. In some cases, the extravasation is as it were separated into several portions, by bridles, adhesions or partitions. If this condition could be anticipated, we ought not to confine ourselves to the application of a single crown, but apply two of them, one on each side, as has been advised for example, when we operate in the neighborhood of the sutures or the track of the venous sinuses.

When trephining is employed to extract or remove splinters, the operation exacts some special modifications. In the first place, the point of the centre-piece should be applied upon the border of the bone which presents the greatest solidity, while the crown at the same time is directed upon the two sides of the fracture. Afterwards, as soon as the effusion is removed, (*détruite*,) nothing remains but to attend to the splinters or depressed (*enfoncées*) portions of bone. We detach every thing proper to be removed, either by means of the forceps or cutting-pliers, but never, unless in a case of necessity, by the aid of a chisel, gouge or mallet. To raise up the parts that have been merely displaced, we have recourse to levers of different forms. The tripod (*trépied*) of the ancients, the triplid elevator of Scultetus, an instrument similar to the screw-ring of the Coopers, are no longer in usage. The elevator, armed with a bridge, as proposed by J. L. Petit, (*Nouv. Elém. de Chir.*, t. II., p. 679;) and the same instrument as modified by Louis, are alike rejected. All surgeons at the present day confine themselves to the simple elevator, a shaft of steel about six inches long, curved in the form of an italic *S*, garnished with the teeth of a file upon the concave surface of its extremities, which last moreover are flattened in the form of a chisel or spatula. In a case of necessity, in fact, this last lever could be replaced by the ordinary spatula. Frequently, in cases of fracture, we may, by introducing a chisel or some other instrument into the crack, produce a sufficient separation of the bones for the effused fluids to escape outwardly, so as to render the application of the trephine, properly speaking, unnecessary. In fractures with considerable separation, and in simple widening of the sutures, a remarkable example of each of which, as noticed in an adult, has been given by M. Robert and M. Goubert, we should dispense with perforating the cranium unless the fluids are effused opposite to some other point.

To remove a necrosis, splinter, or solid foreign body, implanted in the cranium, the osteotome of M. Heine, with which M. Demmé, (*Gaz. Méd.*, 1834, p. 644,) of Zurich, had already obtained six successful results in 1833, would be much preferable to the trepan, properly so called. In the absence of this instrument we may in the same cases make use of the flat or convex rowels; but to give egress to the liquids effused into the cavity of the brain the crown of the trepan still has the preference.

E. *Fifth Stage*.—The *dressing* at the present day is much more simple than formerly. We no longer use in practice those oils, tinctures, balsams, (baumes,) and unguents, of which M. Bertapaglia alone had devised more than thirty varieties, and of which the ancients were so lavish. The gold plate of nuck and that of lead recommended by Belloste, are also forgotten. Practitioners at the present day are satisfied with a disc of fine linen, traversed in its centre by a noose of thread which serves to keep it outside, and which is inserted with care between the dura-mater and the bones, by means of the meningo-phylax, a spatula or simple button-probe; in other cases this dossil is advantageously replaced by a small fine compress, besmeared with cerate and perforated with holes. Its middle portion is inserted into the aperture of the bone, while the remainder covers the inner reversed surface of the flaps and the whole wound. The cavity or species of purse which results from this, is filled up with small balls of lint which are covered over by one or more plumasseaux. Some compresses are afterwards placed over these, and the whole is maintained by means of a bandage, which the surgeon arranges sometimes in one manner and sometimes in another, or by a simple triangular handkerchief, or the couvre-chef of Galen, or better yet by an ordinary cotton cap, or serre-tête, or, as Heliodorus had already recommended, by a net-work of hair, (filet à cheveux) which the Spaniards use under the name of *reddizella*, and which is worn among us as a head-covering for young girls. [For most of these forms of head-dressings, see our Vol. I. T.]

Mynors and M. Maunoir recommend that there should be no portion of dressing used in the opening in the cranium, but that the integuments should be brought together and kept in contact by means of adhesive plasters. Blount and Herlich, who have given the same advice, say they have followed it with success. Others have gone still farther. A personage is mentioned in whom a portion of the cranium had been replaced by a corresponding piece taken from the cranium of a dog; and M. Maunoir thinks the opening made by the trepan could be filled up in this manner! It would appear even that this unnatural transplantation, which was made trial of in Germany, has been attended with some successful results. (See Vol. I.) To me it appears evident that the approximation of the borders of the wound, would not prevent the effusion of a certain quantity of fluids between the dura mater and the scalp. It is, moreover, most usually desirable to leave the solution of continuity

open, to give exit to the effused fluids, and to enable us to cleanse the morbid cavities (foyers) a sufficient length of time after the operation. [For Dr. Mott's views on this subject see Vol. I.]

§ V.

The *consequences* of trephining exact no care which may not easily be obtained for the patient. The dressing should be renewed every day, once or many times, if the abundance of the discharge appears to require it. When the suppuration is dried up, and the cerebral affection has disappeared; when, in fine, nothing remains but the wound of the operation, we proceed to hasten its cicatrization. Consequently we endeavor to approximate its borders, and treat it in other respects like any other simple wound. This cicatrization presents some peculiar phenomena. Sometimes the circumference of the opening of the bones becomes attenuated and seems to approximate to its centre, to become ultimately blended with the dura mater and the envelopes of the cranium. At other times especially when the opening into the cranium is very large, its borders only become blunted and rounded; cellular granulations rise up from the fibrous membrane, gradually fill up the aperture formed by the crown, become more and more solid, and ultimately agglutinate with the exterior soft parts, from whence results a real plug (*bouchon*) of which Duverney has preserved a very beautiful specimen. Whatever may be done, there generally remains after the cure, a sufficiently deep depression upon this cicatrix, the slight thickness of which sometimes allows of the movements of the brain being perceptible externally.

In such cases it has been also recommended, in order to prevent cerebral hernia, to keep applied upon the cavity which I have just mentioned, a convex disc, or plate of lead or any other metal. To show the necessity of these sorts of plates, *Monro* mentions the case of a young girl, who, thinking she might dispense with one which she had worn for a long time, was soon seized with cerebral accidents of which she died at the expiration of five days. As metallic substances readily become charged with caloric, it has been apprehended that among those persons especially, whose position in society obliges them to remain exposed to the rays of the sun, they might give rise to serious accidents. At present they are replaced by pelotes of leather or boiled pasteboard (*carton bouilli*) which are adjusted like the pelote of hernial bandages.

If a necrosed plate of bone should continue imprisoned (*engrênée*) in the soft parts in such manner as to resist, as has been sometimes observed, the action of the forceps, we must then, after the manner of *J. L. Petit*, lay it entirely bare and isolate it, and raise it up and extract it by means of an elevator or any other lever. *Colomb* (*Obs. Méd.-Chir.*, etc., p. 263) thus laid bare and was enabled to remove a necrosed portion of the inner table of the cranium. *M. Gérard* (*Thèse*, p. 53, Strasbourg, 1802,) was less fortunate with an imprisoned necrosis of the whole thickness of the

bone; Guenot (*Anc. Journ. de Méd.*, t. XVI., p. 37) professes to have successfully removed on one occasion the whole frontal (coronal) bone, together with the ethmoid and some plates of the nose! In a patient mentioned by Hevin (*Pathol.*, t. II., p. 171) the internal table only on reaching it with the trepan was found carious. In young children, and even in some adults, instances of which are related by Morgagni and Pestalozzi, (*Lettre à un Méd. de Province*, p. 65, 1747,) the cranium is sufficiently thin to enable us to perforate it by scraping it with a rasp, as is recommended by many authors. The crested saw, or one of the small ones of Hey, should replace the crown, if we have nothing more to do than to remove some salient angle of one of the borders of the fracture. If the necrosis should not extend through the whole thickness of the bone, or if the morbid collection (foyer) was situated between the two tables of the cranium, the rasp or the perforating trepan would doubtless be sufficient, and we should be on our guard against penetrating as far down as to the dura-mater. But wherever the disease extends down to the membranes, it would be dangerous to follow the advice of Hippocrates, by leaving at the bottom of the opening an osseous lamella, however thin it might be, and counting on its exfoliation to give the effused fluids an opportunity of escaping externally.

De La Motte (*Tr. d'Accouch.*, t. II., p. 1062) remarked that on the separation of the sequestrum the meninges were found covered with fleshy granulations, which protect them, he says, from the vitiated air of the Hôtel Dieu of Paris. The bones of the cranium, isolated from the dura mater and pericranium, do not die, says Abernethy, (*Journ. de Litt. Méd. Étrangère*, t. II., p. 341,) but in proportion as they are separated to a great extent. This is a remark, the truth of which I have often had an opportunity of corroborating, especially at the tender age of life, and it is one which, though it justifies trephining in cases of necrosis, should nevertheless deter us from deciding too hastily upon this operation. I will add to the instructions which I have elsewhere given (*Opérat. du Trépan*, 1834, in 8vo.) upon all these points, that in some cases detergent or any other kind of injections, according to the indications, will serve to hasten the cleansing of the morbid cavity as well as the rest of the wound, and that it would be improper to neglect their employment.

[INJURIES TO THE HEAD.

Concussion.—Mr. Guthrie (on *Injuries to the Head affecting the Brain*, Lond., 1842) differs from the opinion of some, that a diminution of the size of the brain, or its subsidence from the interior of the bones of the cranium, is the cause of sudden death after concussion. He justly cautions against the practice of bleeding, or strong stimulant drinks, or strong stimuli to the nose; for the patient is pulseless, motionless, of a deadly paleness, &c., all the reverse of sanguineous congestion; so that bleeding would be fatal, or injure even after the circulation begins; and stimulating drinks might

strangle him, while stimulant salts to the nose would probably subsequently give rise to inflammation of the nasal passages and throat. He therefore, in such cases, recommends *mild* stimulants and *disagreeable* smelling substances, with partial as well as general friction with the warm hands, until it is ascertained that life is extinct. Vomiting is a favorable symptom, because it shows reaction has commenced. If the breathing should continue constantly stertorous, it is a proof of continued irritation, or of compression and extravasation, rather than of concussion.

Too much bleeding, early in compression, will bring on convulsions and syncope, contracted pupils, deadly paleness, and *breathing on the right side of the mouth for a few minutes, with the whiff or puff so peculiar in cases of compression of the brain*. At the moment when the stage of depression is slowly passing into that of excitement, it would be hazardous to bleed over five or six ounces. When excitement or inflammation has fairly begun, and the patient, though disposed to coma, is, when roused, still irrational and impatient, we must not temporize with blisters or purgatives, but proceed to bleed the patient, to whatever extent required to abate the symptoms; and this is to be done to nearly fainting, and *while he is sitting up*, the latter part of which injunction, says M. Guthrie, is far more important than most persons suppose, as we may see strikingly illustrated in apoplexies. This bleeding must be steadily repeated as the symptoms recur, until relief is obtained, or until the powers of the patient can no longer resist the disease or the remedies. In robust persons, two hundred ounces of blood have been thus abstracted with benefit in two or three days.

Fractures of the Cranium.—Mr. Guthrie, (*Op.cit., Injuries of the Head*), in all his vast experience of fractures of the cranium in military and civil life, has never actually known the inner table to be separated from the outer, without positive marks of an injury having been inflicted on the bone or pericranium, however slight that injury may have been; and although it is not possible to doubt the fact of fracture of the inner table alone having occurred, we should be cautious not to let any prepossession of this kind get hold of our feelings, or the trephine may be injuriously resorted to without cause.

In the cases of a clean division of the scalp and outer table, as by sabre-cuts, &c., without fracture, he recommends antiphlogistic means and immediate reunion by first intention. When the instrument even penetrates to the diploe, this practice is to be preferred, though there may be some slight exfoliations, and that the external wound may not unite by the adhesive process. If the instrument has penetrated through the inner table, this, as is well known, will generally be found to be broken, always to a greater extent than the outer, and to be separated from it and driven into the membranes or brain, though on the surface of the bone the edges may appear to be merely separated. The most careful and thorough probing is here required to ascertain the true state of the parts, as even where the fragments are driven into the brain, the patient

may only complain of being slightly stunned, saying that he is not much hurt, and that he will be well in a few days. Otherwise the patient may, as in a case he gives, (*Op. cit.*, p. 85-87,) be, even as late as the fourteenth day, when all is supposed to be going on well, seized with paralysis and coma, ending in death—showing, on dissection, a fragment of the inner table, separated from the diploe and driven through the membranes into the brain, where it had caused suppuration. In all such cases, the trephine or the straight saw must be used, if it be only in anticipation of the symptoms mentioned.

In depression from fracture of the skull in a *child*, however, the inner table is not *brittle*, but bends equally, and does not break; it very often does little mischief when depressed, and gradually recovers its level. The brain in young persons is also softer and more compressible, and can therefore bear more; consequently the trephine, under the age of fifteen or sixteen, must be used with caution, as it is also a well known fact, continues M. Guthrie, that, in the records of surgery for the last twenty years, the greater number of successful cases of recovery from depression, or from fracture and depression of the skull, which were not trephined, were in young persons. M. Guthrie gives a case of a small child, who fell over the bannisters of a house in London and fractured the parietal bone, producing such a remarkable hollow or depression, that it might have held the half of a small orange. At first insensible, it shortly after gasped, the next day was leeches and purged, and soon was enabled to walk about quite recovered, the hollow still remaining for several weeks. Neither the trephine nor any other means than those mentioned were had recourse to. The long bones in children, also, rather bend than break.

Trephining in crowded hospitals is dangerous, as probably one out of ten, Mr. Guthrie thinks, would, under such circumstances, die from inflammation of the brain and its membranes, &c. Mr. Guthrie does not, according to a modern suggestion, [which finds its germ, we presume, in sub-cutaneous surgery. T.] consider such results imputable to the admission of air. He thinks inflammation of the dura mater, and formation of pus between it and the bone, was much more common from injuries of the head in the time of Dease and Pott than since. He has rarely seen the secondary tumor described by them; and the same remark was made to Mr. Guthrie by the surgeons of the hospitals of London, of whom he made the inquiry, (*Loc. cit.*, p. 122.)

M. Aran (*Sec Archiv. Gén. de Méd.*, Janv., Feb., et Mars, 1845; also *Gaz. Méd. de Paris*, Juin 7, 1845, p. 364-365) combats wholly the ancient and still prevailing opinion of fractures of the cranium, by what are called *contre-coups*; *i. e.*, where the base, for example, is fractured by a blow on an opposite or distant part. M. Aran classes all these fractures by *contre-coup* under two heads, *viz.*: 1st, Those that are *independent*, *i. e.*, where the part struck as well as the distant one are both fractured; 2d, Where the fracture is produced by *irradiation* or prolongation, from the place struck and

fractured to the base of the cranium, for example. The sutures, he thinks, present but little resistance to these. In fractures of the cranium from falling on the feet, he thinks it is the effect of the direct concussion transmitted through the whole column, from the feet to the head. The thin bones at the base of the brain, he thinks, escape these contre-coups, by yielding when the percussion is transmitted from a distance, whereas, if it had been direct, they would have been shattered. So in the squamous portion of the temporal, &c.; whereas, the more solid bones of the vault of the cranium would be likely to fracture by their very unyielding density.

M. Aran has made a number of experiments on the heads of dead subjects, striking them with hammers, &c., or precipitating them from certain elevations *head-foremost*. These are some of his principal conclusions: He has never known a fracture at the base without one at the point struck also; in other words, he has seen no fractures by contre-coup, so called, at this region; that these fractures generally arrive at the base of the cranium by the *shortest curve*, *i. e.*, the shortest radius; that fractures by irradiation from the base, constitute ninety-nine out of one hundred of fractures at this part; that those consecutive to percussions and fractures on the frontal bone are found, by his experiments, to terminate generally in the anterior third or upper floor of the base; those of the occipital bone, in the posterior third or lower floor; those of the temporal bone in the middle third or middle floor; while those on the sinciput may follow one of these three directions, but their tendency is to the middle fossæ.

Fracture of the Petrous Portion of the Temporal Bone.—Hemorrhage from the Ear, &c.—A New Anatomical Point of Diagnosis suggested.—A case recently occurred to M. Blandin, at the Hôtel Dieu, Paris, (*Annales de Thérapeutique*, Mars, 1845; Cormack's *London & Edinburgh Monthly Journal*, June, 1845, p. 461, etc.) of a man aged thirty, who in a fall fractured the petrous portion of the temporal bone, causing hemorrhage from the left ear and mouth, slight defect in the hearing, and slight paralysis of the muscles of that side of the face, with paralysis also of that side of the uvula, to such extent that it was drawn to the right side of the base of the tongue, by its muscles on that side now having no antagonists. This case has apparently established an important, but hitherto obscure, point in anatomy, and thus furnished a new diagnostic mark in pathology in such fractures. The coincidence of paralysis of the face with that of the velum palati in several such cases (but not always) had been noticed by M. Monteau. It is known that the uvula receives its nerves from the sphenopalatine ganglion by three filaments, which go from this ganglion to the uvula and velum. But the ganglion itself also receives a filament from the intra-cranial portion of the facial nerve, as has been shown by MM. Blandin and Longet. This, however, had been *erroneously* supposed to be a filament sent from the ganglion to the vidian nerve; whereas, it is now found to be a distributor of nervous influence from the vidian nerve to the uvula and velum. From whence we have the

key to the condition of these parts in the fractures in question, and the explanation why lesion to the intra-cranial trunk of the facial nerve must produce paralysis in the filament which goes to the sphenopalatine ganglion, and afterwards leaves it as the *motor* nerve of the uvula. The uvula, consequently, is only paralyzed when the cause of the paralysis of the face is within the cranium, close by the petrous portion of the temporal bone. Therefore, we have this valuable diagnosis: when there is paralysis of the face alone, without accompanying paralysis of the uvula, we may affirm that the lesion is external, or in the peripheral branches of the nerve. The hardness of hearing is sufficiently explained when the injury is within the cranium. M. Blandin considers hemorrhage from the nose and mouth in such cases as unequivocal signs of fracture of the petrous bone; the blood emanating, he thinks, from the interior of the tympanum, where it is extravasated and escapes anteriorly by the external ear, (which presupposes rupture of the *membrana tympani*,) and posteriorly by the Eustachian tube, through which it finds its way to the throat. M. Blandin has verified these conclusions, by repeated dissections.

On the other hand, Drs. Lawrie and King have recorded *twenty-two* cases of cerebral concussion (Cormack, *Loc. cit.*, p. 462; also same Journal for 1843, p. 673) at the Royal Infirmary of Glasgow, in which there was hemorrhage both from the ear and mouth, and yet *twenty* of these cases recovered, and in one only of the two fatal cases was there fracture of the base of the cranium found on dissection. Dr. Cormack (*Ibid.*, *Loc. cit.*) speaks of three similar cases, all of which were cured, and which place in doubt the opinion that hemorrhage from the ears and throat, even where it is abundant and accompanied with violent concussion and alarming cerebral reaction, as it was in all these cases, is a conclusive evidence of fracture of the petrous or any other bone. In one only of these three patients there were both paralysis of the face and deafness; but the uvula was not examined. Dr. Cormack considers in fact that fractures even of the petrous bone may recover.

M. Gerdy (*Ib.*, *Loc. cit.*, p. 463) is stated to concur also in the belief that the hemorrhages in question do not always indicate fracture.

Again, in the *Annales de Thérapeutique* of Paris, for May, 1845, (See also Cormack's *Lond. and Edinb. Month. Journ.*, *Loc. cit.*, June, 1845, p. 463, &c.,) we have three illustrative cases at La Charité, two belonging to M. Gerdy himself, and one to our author M. Velpeau. In the first a stout young mason received only slight contusions apparently on the head from a fall from a scaffolding, and was stated to have been at first insensible for a few minutes. For three days there had been, it was said, abundant hemorrhage from the right ear, which continued on his admission into the hospital the evening of that day, also slight head ache, strong pulse and hot skin. After two or three venesections and doses of tartar emetic [!] and antiphlogistic regimen he left the hospital well. The discharge from the ear had ceased on the fourth day, and it

was found that the membrane of the tympanum had been ruptured, as the air hissed out freely through it, in making an effort to blow with his mouth and nose shut. There was no palsy of the face, deviation of the uvula, or other symptom of compression, which latter M. Gerdy considered would have resulted from accumulation of blood at the base of the cranium, had there been fracture of the petrous bone.

The second case was also a robust young man who fell down stairs and struck the right temple. He was almost insensible, and the ear on that side soon discharged blood and became slightly deaf. On the fourth day after the accident he was admitted into the hospital, and was found to have a large bloody tumor on the temple. The discharge of blood from the ear had ceased; the deafness continued; the pulse was hard, and the patient complained of a throbbing head-ache on the side which had been struck. There were, however, no symptoms of compression, and no facial paralysis or deviation of the uvula; nor was the membrane of the tympanum torn. So that the blood must have come from the outer ear. M. Gerdy cannot think there was fracture in this case.

The third case was that of M. Velpeau, of which we regret to have met with no other details except that the patient was admitted on account of various injuries, and had a discharge of blood from the ear, which however was not apparently connected with any deep-seated lesion.

The editors of the Paris Journal in which these cases are given (*Annales de Thérap.*) conclude from all the above facts, that in the present state of science, hemorrhage from the ear under the circumstances described, does not permit us to pronounce that a fracture exists, even though the hemorrhage may be accompanied by paralysis of the face and uvula.

It is to be borne in mind that in fractures of the os petrosum of the temporal bone, the diagnostic mark of deviation of the uvula to one side by the preponderating antagonism of the muscular fibres on the sound side, cannot take place (unless through the muscular fibres of the velum) if what M. Lisfranc says (*Clinique Chirurgicale de la Pitié*, Paris, 1842) that this projection is sometimes destitute of any deep fibres.

Fracture of the Frontal Bone and Depression.—It is true, nature can and will at times make apparently almost more than superhuman efforts in the work of reparation to the organization, even where she has had to contend (as the ancient fable has it) against the fearful alliance both of empiricism and the disease. But this is no argument why we should, with a full knowledge of our duty, stand by idle, and compel and torture her to put such powers to the test. Thus with the indisputable truth before us so often demonstrated, that a depressed portion of a fractured bone of the cranium will almost inevitably cause either immediate rupture of the vessels of the brain, with convulsions, coma and death, or subsequent extravasation, separation of the dura mater, inflammation, and suppuration, and death in that shape also; and with the extraordinary fact

that a recovery may take place, and leave the patient ever after subject to epileptic convulsions ending in idiocy; how, we repeat, with this knowledge before us multiplied in ten thousand examples, and with the knowledge also of the equally established precept in surgery, that all these accidents in ninety-nine out of one hundred cases have no other chance of cure than by the elevation and exsection of the depressed fragment, can we conscientiously look silently on and see a case of this kind pass on through this fearful ordeal of symptoms without at once applying the needful remedy! Yet such appears to have been the fact in the case of a boy, aged 5 years, described by Dr. Pinefoy of CloghJordan, Ireland, (See *London Lancet*, Dec. 28, 1844, p. 400.) This little patient, with a fracture of the frontal bone an *inch long* and depressed a *quarter* of an inch, caused by the kick of a horse, and most unequivocally pronounced, was allowed by this physician to pass during the subsequent days through acute inflammation and fever, with violent convulsions, coma, apoplectic stertor, &c., he employing only two slight venesections, a few leeches, and some calomel, and above all the *douche of cold water* let to fall upon the vertex from a height of two feet, to which dangerous experiment (as we deem it) he attributes the cure—aided by the recuperative powers of nature in young subjects! This truly is a fearful mode of demonstrating pathological possibilities, and an abuse, as it seems to us, of the principles of *conservative surgery*.

Compression.—Mr. Guthrie (*Op. cit.*, Injuries of the Head, &c., London, 1842, p. 40) correctly, in our judgment, considers compression not, with Sir C. Bell, the result of a diminution in the quantity of blood in the brain, but rather of a plethoric state of the vessels of that organ, and of some integral change caused in the whole volume of the brain and its functions by such compression, as from a clot of blood or depression made by a *mere point of bone*, &c., in fracture, the removal of which immediately removes the coma, &c., while an *ounce of lead* may lie quietly in the brain without causing any unpleasant symptoms. Hence it is not so much the actual pressure, as Sir C. Bell, Serres, Gama, &c. think, that causes these symptoms, as it is *irritation*.

Mr. Guthrie gives as an example of this truth some cases of compression he has seen, wherein the pulse was remarkably quick (145) till life ceased, accompanied with paralysis of the *left* side, and the *whiff-like breathing* on the *right* side of the mouth, convulsions, loss of speech, &c. He was so struck with the *flatness* of the convolutions of the brain on the right side as compared with those of the left, that he sliced off a portion, and immediately came to a larger coagulum of blood than he had ever seen without causing immediate death. This coagulum pressing from within outwards, was, he thinks, the undoubted cause of the appearance mentioned, (*Op. cit.*, p. 47.) Here is another proof of the symptoms of compression caused by actual mechanical pressure.

In those well-marked gun-shot injuries in military service, where the fracture, as of the parietal bones, and extravasation are the only

lesions, with the insensibility from the extravasation coming on at a considerable interval after the infliction of the wound, the rule in surgery to remove the bone is absolute. So also thinks Dr. Cormack, (*Lond. and Edinb. Month. Jour.*, Oct., 1843, p. 922.) When these cases are complicated with concussion and deep-seated extravasation, the diagnosis is difficult. When the brain remains depressed after the blood has been removed, the symptoms are not mitigated.

Among the most remarkable cases on record in proof of the *destruction and loss of cerebral substance* which the encephalon may undergo by fracture, without in any way impairing the intellectual or physical functions, is one which recently occurred to Mr. C. G. E. Ford, of the Madras Medical Establishment and 7th Madras Native Infantry, East Indies, (See his account in Cormack's *Month. Jour. of Med. Science*, Sept., 1845, p. 652, 657.) An East India boy, aged 15, received a bullet wound which entered the brain above the *right* ear, and passed out of the forehead over the *left* eyebrow, causing a fracture which extended from the occiput posteriorly, to the place of the ball's exit on the left os frontis. There were few or no spiculæ or fragments, the concussion of the ball appearing to have been expended (as we should think) in the extensive prolongation of the fracture. There was little or no depression for the same reasons. The hemorrhage fortunately was *abundant*. Symptoms of stertorous breathing and unconsciousness, &c., however existed for a short time, followed by severe reaction and inflammation of the brain,—which were subdued by leeching and judicious treatment. On the third day a mass of *protruded brain half an ounce in weight* and larger than a walnut, was excised at its place of exit at the wound of the forehead. Suppuration and sero-sanguineous effusions took place extensively in the wounded parts and tissues, which in different places required dilating. *Portions of brain* were also *discharged* from the occipital wound. All the effect of these extensive injuries on the organic functions was a slight loss of motor power in the left eye, and left upper and lower extremities, without however loss of sensibility in the latter, of all of which he gradually and completely recovered in less than one month and a half! So that not the slightest lesion remained to the patient either in the hearing, smell, taste, sight, touch, memory, disposition, intelligence, locomotion, &c.!

Ball-wounds perforating the Brain through and through, without causing immediate death.—It is now deemed an established fact in pathological surgery, that an *ounce ball* or one even of larger dimensions may perforate through and through the anterior lobes of the brain transversely, as from temple to temple, and the patient yet retain all his faculties, digestion, sleep, reason, &c., for the space of 20 or even 30 days, until inflammation and suppuration ensue, and thus necessarily cause death. A case of this kind very recently occurred in America, at St. Louis, (State of Missouri,) in a gentleman thus wounded in a fracas. The particulars of another still more remarkable case are related by M. Blaquièrre, (*Journ. des Con-*

naiss., &c., Paris, 1844,) where a pistol ball, weighing the seventeenth part of a pound, passed through the anterior and lower part of the brain, of a child at Mexico, in 1842, aged only four years, each perforation being situated in the temple at the same locality, nearly, *i. e.*, about an inch and a half perpendicularly above the outer angle of the eye. *Six days* transpired of apparently, almost *uninterrupted health*, when inflammation and suppuration supervened, and the child died, not however until the *twenty-ninth day* ! *The aperture at the entrance* of the ball was found as usual in all bones, less than that at its exit. The cerebral substance between the track of the ball and the frontal bone, being a distance of 6 or 8 lines in extent, was found thickened. The substance of the brain above the track, and also the ventricles remained intact. The meninges were inflamed, and the perforation filled with pus.

Abscess of the Liver from Fracture of the Head.—M. Blandin (*Annal. de Thérapeut.*, Paris, Mars, 1845,) considers inflammation of the veins of the diploe followed by suppuration, and which, it is said, was first noticed by Bruce (See Cormack's *Lond. and Edinb. Monthly Journal*, &c., June, 1845, p. 462) to be the source of abscess of the liver, so frequently observed after injuries of the head. This must be by means of phlebitis propagated to the liver; but why to the liver rather than elsewhere? And would not the same phlebitis, caused by injuries to the vessels in severe operations, as removal of the breast, testicle, &c., explain the sudden formation of purulent collections in the lungs, and other organs causing death?

Dr. Cormack (*Ib.*, *loc. cit.*, p. 463) doubts, we perceive, the alleged frequency of abscesses of the liver, after injuries of the head, from inflammation of the venæ Santorini.

But *modern science*, without boasting of the advances of the moderns in scientific truth, except that investigations are in every department now more rigidly conducted upon the Baconian principle of the analysis of facts and experiments, shows conclusively that the *liver* and its secretions and functions, as the ancient writers of even two centuries since affirmed, without the test of organic chemistry to enlighten and sustain them, exercises a far more important office than many had imagined. Its magnitude, as compared with other organs, during intra-uterine life, would have led to the conclusion of its high importance in the animal economy; even supposing it to have been (as some still think it to be) merely one of the *vegetative* system of organs. But organic chemistry has now established, by the intimate connection of the great function of the liver, *i. e.*, its elaboration of bile from venous blood, and the absolute and indispensable importance of that secretion, as the chief chemico-organic re-agent in the elaboration and supply of *all the blood itself of the system*, that the liver is, as it were, (and as the Greek pathologists foreshadowed) placed at the very *basis* of the functions of organic life, and consequently of all pathological phenomena. The analysis also of the bile and urine, their vicarious or con-sociate functions, and the direct arterial and secretory connection of the kidneys with the brain, as the excretory drain of the predo-

minating nitrogenised products of the last organ, still further elucidate the close union of the hepatic functions with both. Why then should not revulsions or metastases naturally take place to the liver, bladder, and kidneys in all injuries to the brain? Every practitioner in medicine also knows how closely affiliated the functions of the kidneys, (and consequently those of the liver) are with the morbid phenomena of fevers, &c. Thus, that of suppression of urine and cystitis, &c., as indicative of dangerous cerebral lesion, &c.

Long, deep Incision and Issue on the Scalp.—In the list of bold surgical remedies, lately proposed for cerebral difficulties, we have here to record that of a *long, deep incision in the scalp*, as a means of local sanguineous depletion and counter irritation, and which Mr. Richard Smith, of the Bristol Infirmary, (Eng.,) has been in the habit of employing, (*Braithwaite's Retrospect*, Vol. VIII., 1843, p. 176; and *Transact. of the Provincial Med. Association*, England, Vol. II., p. 307–336,) whether there be, or be not, symptoms of fracture or depression. Dr. Geo. Wallis, also of Bristol, in a paper on this subject, (loc. cit.,) states that he derived the hint of this practice from Mr. Smith, and has been in the habit of employing it in a variety of cases of organic affection of the brain, both chronic and acute, paralysis, impending effusions, convulsions, erysipelas of the head, and of the membranes of the brain, in fever in the very advanced stages, &c. He uses it as a *dernier ressort*, when all other means have failed, and therefore not in the onset. It is, however, precisely in the beginning of acute local affections of the encephalon, that we should, *à priori*, suppose this remedy, long since and still practised (See Riley's *Narrative of Sufferings in Africa*,) by the Bedouin Arabs in Africa, by means of large heated sharp knives, upon the thigh, &c., eminently useful, both as a powerful means of depletion and counter irritation. If, in acute diseases, serious effusion has filled the ventricles, the efficacy, Dr. Wallis thinks, will be doubtful. In the operation, he first shaves the head, and drawing the scalp firm, makes the incision from the beginning of the lamboidal suture, following the course of the sagittal suture through its whole extent, and cutting entirely through the soft tissues, say to the extent of seven or eight inches in an adult, so as to leave a wound large enough to insert a *dossil of lint* rolled hard, of the thickness of two fingers, and saturated with turpentine! This last procedure is certainly even more daring and painful, we should judge, than the first incision. Six or eight ounces of blood only will be lost, and the arteries soon cease to bleed, while the turpentine helps to suppress the hemorrhage, by rapidly promoting suppuration. But if the patient has already lost sufficient blood by the arm, &c., before this incision is had recourse to, further depletion from this wound may be prevented by placing the lint pledget so that it does not rise above the edges of the incision, and then strapping the whole down by adhesive plasters. Here you will find, Dr. Wallis says, the advantage of having divided entirely through the scalp at first, for, if this has not been done, many of the arteries, only partially severed, will continue to bleed. If the tur-

pentine does not arrest the hemorrhage from all the arteries, these can readily be closed by the *actual cautery*, and this without the patient knowing it. This *finale* of the cautery certainly seems in keeping with the severity of the operation in all its stages. The common thick plaster-knife, kept in the fire near by, will answer for a cautery. The arteries divided in this operation are the coronal branch of the temporal and the anterior superior branch of the occipital; two, therefore, on each side. When, however, you wish to obtain much blood, you encourage the bleeding by sponges dipped in warm water. The dossil of lint in dressing should be made to press the wound open as wide as possible. Unless the transverse straps are long and firmly put on, and well supported by a double-headed bandage, the patient, while lolling about, or using his hands at night, during delirium, will set the arteries a-bleeding again. In one case of this kind, Dr. Wallis saw a terrific hemorrhage induced. This, we should suppose, would be one of the greatest dangers to be apprehended, and might we not suggest also, from the irritation of so long and deep a wound, the production of erysipelas upon the scalp; though recommended it appears by Dr. Wallis, as a curative resource for this very dangerous disease itself. Thus, he admits that the straps should be cut away the *next day*, or as soon as you are safe from the hemorrhage, because of the *inconvenience* they occasion to the patient by their *pressure*, and hence the *great relief* their removal gives to him, especially when a *bread and water poultice* is then applied over the lint.

The suppuration, if scanty, is to be encouraged by the reapplication of the dossil of the turpentine now diluted by *yellow resin*, or we may use *diluted blistering*, or *savine ointment*, &c. In a few days, a *double row* of peas, 70 or 80 strung together, may be placed in the wound, to keep up the issue, and prevent granulations filling up the wound—a point difficult to accomplish, when the discharge is to be kept up three or four months. This, too, is in keeping with three previous rather harsh steps of the process, and the last or fifth, to effect this drain, is the *repeated application of caustic* every five or six days. Dr. Wallis furnishes several cases of cures by this new process, and we can readily believe it; but where is the patient in private practice, that would consent to it, or the physician that would dare to employ it? Hence, doubtless, the little favor with which it has been received. No doubt that this resource, violent and barbarous almost, as it seems, may be often valuable and curative. The brain requires potent agents to make it respond to treatment.

Dr. Oke of Southampton (Eng.) has been the first to break ground in the above practice after MM. Smith and Wallis of Bristol. He publishes a case in corroboration, (*Braithwaite's Retrospect*, Vol. X., 1844, p. 209, et seq.; and *Provincial Medical Journal*, Sept. 18, 1844, p. 384,) in which it appears to have been attended with beneficial effect, during a high fever and severe delirium, which supervened in a boy, aged 7, a few days after an attack of scarlatina, and after all other means [mercury among them of course, as it is the

constant bane which physicians will persist in using in every disease whatever—see all medical works and treatises of the last 30 years, *passim*—happily often discarded at last on the continent of Europe. T.] had failed; but the suppurating drain kept up did not prevent the anasarca swellings so common as the sequelæ of scarlatina!

As usual in new medical remedies and new surgical operations, whether actually new or not, new competitors arise as soon as these discoveries make a noise, and old reminiscences being awakened, it turns out as in this remedy that Dr. J. Johnson (*London Medico-Chirurgical Review*, Oct., 1844, p. 575) has been using it for epileptic and other cerebral maladies for over *thirty years*! For proof of which he points to the leaves of his journal (*Loc. cit.*) just mentioned. But his claims, after all, rest only, as it appears by his own showing, upon a mere line drawn on the sagittal suture with *kali purum*, afterwards poulticing till the slough clears away, then inserting a few threads of silk or cotton daily, imbued with the *ceratum lyttæ* kept up even for years! So the honor of this rather *veterinary* resource (but none the worse for that) must still among the moderns accrue, we think, so far to Messrs. Smith and Wallis. Dr. Blackmore, also, (*London Med. Gazette*, March, 1845, p. 728, and *Dr. Ranking's Half-yearly Abstract of the Medical Sciences*, Vol. I., 1845, p. 29, Langley's American ed., New York,) comes in for his share. He too is far more circumscribed in the limitations of his incision, but full as deep, and has, too, been using it for some time in spasmodic cases of an encephalic kind, also in hemiplegia and mania, especially when there has been a *fixed pain in the head*, or a tender portion of the scalp, so that gentle percussion has produced great pain, or where there has been a convulsive or an hysterical fit, in which cases he considers the bleeding it causes by far the most powerful of any other mode of depletion. This practice should not, he says, be confined as formerly to cases of disease in the pericranium, nor as a last resource in chronic affections of the brain and its membranes, nor should it be used as a first step to the making of the *enormous issue* lately recommended (above.) Such an incision, with 70 peas, &c., may bring a good practice into discredit and terrify patients who would readily submit to a three-inch incision, as recommended by Dr. Blackmore. This physician brings to light another and a last competitor in the person of the late Dr. Abercrombie, who he says first suggested it to him and had long used it with great success, where with symptoms of internal disease some portion of the scalp had become tender. Dr. Blackmore suggests that it should not be confined to this, but that it should be extensively employed as a most efficient means of local bleeding. We concur with him in opinion, and that his restricted incision is preferable. Every case, in fact, of wound of the scalp or of compound fracture almost, especially of the cranium, has for centuries demonstrated its utility wherever the wound has bled profusely.

Statistical Table of Wounds of the Head.—MM. Lawrie and King (Cormack's *Monthly Journal*, &c., 1844) give the following results of their observations, upon a total of 234 cases, in most of which the *trephine* was used :—

	No. of Cases.	Cures.	Deaths.	Incom- plete.
Concussion, (commotion,)	110	94	11	5
Apparent concussion, but doubtful,	8	—	8	
Sanguineous extravasation, { without fracture,	8	1	7	
{ with simple fracture,	12	—	12	
{ with complicated do.	4	—	4	
Simple Fracture of the Cranium, { simple fracture,	3	1	2	
{ with depression,	3	3	—	
{ with “ and operation,	5	—	5	
Compound Fracture of the Cranium, { compound fracture,	10	6	4	
{ with depression,	19	14	5	
{ with depression, or comminuted, and the operation performed in 24 hours after the accident,	26	7	19	
{ with depression, or comminuted, and the operation performed some days after the accident,	14	3	11	
Hernia cerebri,	12	2	10	
	—	—	—	
	234	131	98	

Out of 77 cases of compound fracture, there were 29 cures and 48 deaths ; 26 of these 77 cases were not trephined, and of them 18 were cured and 8 died ; 51 of the 77 cases were trephined, and of them 11 were cured and 40 died.

ARTICLE II.—THE FACE.

I have mentioned, while treating excision of the nerves and excision of the jaws, the cases in which trephining would be advantageous upon the face. I shall again return to this operation, in treating of diseases of the maxillary sinus, and exostoses of the visage. It is, therefore, unnecessary to speak of it at present.

CHAPTER II.

THE CHEST.

After the cranium, the thorax is the part of the body, upon which the trephine has been most frequently applied.

ARTICLE I.—STERNUM.

It was by means of the trephine, (*trépan*)* that Galen removed a carious sternum from a young man, who was wounded while exercising in a wrestling match, and in whom he was obliged to penetrate down to the pericardium, which itself was altered upon its anterior surface.

§ I.—*Indications.*

Avenzoar, according to Freind, recommends the employment of the trephine not only for abscesses of the mediastinum, but also for those of the pericardium. V. D. Wiell performed this operation successfully, for a large purulent collection. Colombo, Salius Diversus, and Juncker formally advise it; and Pauli and Solingen mention that Purmann succeeded with it in two different cases. J. L. Petit adopted their counsel, and the examples of this operation are now without number. A physician of Altorf, (Franck, *Méd. Prat.*, t. V., p. 138,) had recourse to it with success for a sub-sternal abscess; as Ravaton, (*Plaies d'Armes-à-feu*, p. 249, 337, also had, in a similar case, and afterwards in another, to remove some wadding, blood and a ball. Storck, (Monro, *Essai sur l'Hyd.*, § 142, p. 306,) was enabled by this means to remove six pounds of blood and sanguinolent matter from the thorax. According to Sprengel, Boetcher recommends that it should be employed in fractures of the sternum, in order to make a passage to allow of our raising up the depressed fragments, (*les pièces enfoncées*.) As an evidence of its advantages in such cases, De Lamartinière, (*Mém. de l'Acad. de Chir.*, t. IV.,) mentions that a soldier, wounded at the siege of Philipsburg in 1734, recovered perfectly after this surgeon had removed from him four large plates of bone which comprehended the entire thickness of the sternum. Mesnier, of Angoulême, was no less fortunate in a young man who had had this bone fractured transversely. Almost the whole of the caries was removed by means of a very large crown, while the inequalities of the opening were destroyed with the lenticular knife.

[* Unless the *trepan* is specifically alluded to by our author, as meaning to express an instrument somewhat different from the *trephine*, (see his remarks above,) the word now universally employed, we generally adopt the latter as the proper translation for his word *trépan*. T.]

Alary imitated the example of V. D. Wiell, upon a coachman of the king's stables, who had been a long time affected with an internal abscess which had opened upon the neck in the supra-sternal depression, (fossette.) Sédiller of Laval, treated in the same way, a girl of twenty-two years of age, who, in consequence of an abscess caused by a blow upon the front part of the chest, carried a fistulous ulcer through which the mediastinum could be reached without difficulty. The carious sternum concealed a purulent collection, and the patient recovered in two months. An adult patient in whom an internal abscess had opened outwardly between the two first bones of the sternum, was received into the Hospital of Rouen in the year 1754. Lecat enlarged the opening of the integuments, rasped the contour of the bone, which had become altered by caries, and a few days after applied the crown of a trephine; which enabled him to introduce into the cavity the substances (médicaments) suitable for cleansing its walls. Ferrand, of Narbonne, had no apprehension, in a similar affection, though much more complicated, of removing a great portion of the same bone by means of the trephine, and several of the cartilages of the ribs, with the aid of a small saw, in a patient who ultimately recovered. Finally Auran had the same good fortune in treating a simple caries of the sternum. It is however certain, that in this last case the actual cautery was several times substituted with advantage for the trephine. The fact related by Aymar, of Grenoble, is a conclusive proof of it [this use of the cautery.] But Marchettis has made the remark, founded on his own personal experience, that in these cases, the cautery, by heating the neighboring parts, may become extremely dangerous, and that it is not unfrequently incapable of causing the separation of the necrosed bone. In support of his assertion, I could, if it were necessary, adduce what I have seen in one of the hospitals of Paris. The cautery was applied; the necrosis did not exfoliate, and the patient succumbed to the progress of the disease. We may therefore conclude with De Lamartinière, that the trephine is often a precious resource in necrosis of the sternum, whether this necrosis may or may not be caused by an external lesion, or whether it may conceal a purulent collection, or may exist alone.

M. Clot, (*Compte-rendu de l'Ecole du Abouzabel*, 1832,) who, in 1832 gives only two examples of it, states in 1835 (*Journ. Hebd.*, 1835, t. II., p. 297,) that he had succeeded eight times in this manner in Egypt. But at the present day trephining of the sternum, like that of the other bones, is almost always associated in practice with exsection. (See *Exsection of the Sternum*, supra.)

§ II.

The Operative Process, moreover, is subjected to the same rules as for perforation of the cranium, whether we resort to the crown, perforating trepan, Hey's saw, the rasp, &c.; except that the density of the bone being less, it is infinitely more easy to penetrate

into the chest than into the head. The mammary artery could not be wounded unless the disease should oblige us to carry the instrument beyond the borders of the sternum. In his first case, De Lamartinière found it (the artery) so completely isolated that he deemed it proper to protect it, (*la tenir enveloppée*) with lint for several weeks. In another case the hemorrhage it occasioned was arrested by simple styptics. I shall not speak here of the proposition made by some persons, to employ the trephine in order to arrive at the envelope (pericardium) of the heart in cases of pericarditis, nor of that which recommends its use in order to reach the *arteria innominata*, in order to apply a ligature upon it;—because I have elsewhere spoken of the value to be attached to these suggestions.

ARTICLE II.—TREPHINING THE RIBS.

We have seen above that the ancients sometimes had recourse to the trephine to open into the chest in cases of empyema, and that at the time of Hippocrates, some practitioners preferred piercing in this manner a rib, than making an incision into the soft parts. Though surgery at the present day possesses more simple processes for the operation of empyema, it nevertheless allows trephining of the ribs to be useful in certain cases of necrosis, or where foreign substances are implanted (*fixés*) into the body of the bone itself. If, for example, the point of an instrument, knife, sword or bayonet, had broken in a rib in such manner as not to allow of its extraction by the forceps, the crown of the trephine could remove the bone and the foreign body at the same moment. In a case of necrosis, a crown of the trephine behind and another in front would enable us to extract the mortified fragment. If the sequestrum were invaginated in a costal sheath of new formation, [see our notes *supra*, on the Formation of Bones, Sequestra, &c. T.] the trephine would then still be indicated.

It is nevertheless true that in all these cases the sector (*séca-teur*) of the ribs, the osteotome of Heine, and the different kinds of rowel saws which I have spoken of under the head of excision, attain our object much better, so that trephining of the ribs at the present day is, or ought to be, almost entirely laid aside.

To perform it, it would be necessary, should the skin have become adherent and degenerated, and that an osteoform sheath existed there of great volume, to lay bare the whole diseased region by means of an extensive (*grande*) elliptical incision. Upon the supposition that the integuments might be separated, I should, in place of an incision parallel to the rib, prefer a T incision with its stem below, or an incision in form of an arc, with its convexity also directed downwards. The simple incision scarcely ever allows of our isolating the diseased parts properly. By means of the T incision, we are enabled to turn over (*refouler*) in front and behind, a triangular flap, which gives great facility for the employment of the other instruments. The arched incision offers still

greater advantages; for by enabling us to raise up the tissues in the form of a half-moon, it afterwards puts it in our power to allow the flap to fall of itself over the wound.

The soft parts being thoroughly detached and raised up, the surgeon applies a first crown of the trephine in front, if he is about to place on several of them; or upon the diseased region, or the fistulous aperture (point) of the cavity to be opened, if only one is required. The perforations having been made, the section of the hard parts is completed by means of Liston's scissors, or any other sector, after which we have recourse to the forceps to extract the portion to be removed. The vessels to be avoided, and the attentions required for the dressing, are in every respect the same as those I have mentioned under the head of *Exsection of the Ribs*, [supra.]

ARTICLE III.—TREPHINING THE SPINE.

The spinal column (rachis) forming as it does a long canal, enclosing a cord of the highest importance, cannot be affected with caries, necrosis or fracture without exposing to serious dangers. It were to be wished, therefore, that we might trephine or excise it like the cranium, sternum or ribs. It is an operation which Vigaronx (Hevin, *Cours de Pathol. et de Thér. Chir.*, t. II., p. 207) had already proposed in the last century, and one which some surgeons, in fact, appear to have since performed. The first attempt of the kind is attributed to Cline, and the second to Tyrell. A man who fractured the vertebral column was paralysed by the same blow. Supposing that the compression of the spinal marrow depended upon effused blood or some fragments of depressed bone, M. Tyrell (*Bull. de Fér.*, t. IX., p. 173) laid bare the dorsal region of the spine at its lower portion, and came down upon the eleventh dorsal vertebra. Having directed the trephine upon this point, he was enabled to disengage the osseous fragments, and to raise them up. The patient was relieved at first, but he died on the fifteenth day.

This operation, which is to be assimilated to excision or exsection of the spine or of the vertebral lamellæ, and which was performed by A. Smith, with the assistance of M. Dndley, and which I have spoken of farther back, does not deserve, as I think, to be retained in practice. In admitting that perforation or excision on the posterior region of the spine might be positively indicated, I do not believe that the trephine would ever become indispensable. Pure and simple exsection, by means of one of the osteotomes above mentioned, would be manifestly preferable.

[DISEASES OF THE VERTEBRÆ.—TREPHINING THE SPINE ON INJURIES OF THE BRAIN AND SPINE.—DANGER OF ABSCESSES NEAR THE CERVICAL VERTEBRÆ.—A NEW FORM OF TORTICOLLIS, &c.]

A practical and experienced surgeon of the Hospitals and Fleets of England, Mr. James Prior, whose judicious recommendations of conservative treatment in severe compound fractures and disloca-

tions of the articulations, with protrusion, &c., we have in our notes (supra,) had occasion to commend, has made some excellent, though brief remarks, also on the great difference observed in the results from injuries to the brain, and from those of the spinal marrow. The latter, or spinal, as he says, are among the most serious, that affect the human frame, more difficult of diagnosis and treatment, and more dangerous, yet with little indications of inflammation except of an obscure or sub-acute kind. The reverse happens with injuries of the brain; here we have acute inflammation, (with delirium, coma, &c.,) and the power of enduring great lesions, losses of substance, disorganization of functions, &c., yet often ending in speedy recovery. The brain, the largest, noblest organ of this system, is thus often assailed with impunity, the spinal cord never. Yet, both are continuous and the former, believed to be the seat of reason, of intelligence, and all the highest order of functions, while the vertebral column furnishes only, or in great part the powers only of animal life, (*London Lancet*, May 31, 1845, p. 609.) The truth is, Mr. Prior might have added, that the higher the organization, the less exposed is it to loss of its functions from disintegration or destruction of its tissue by *physical* causes; and this law we would eminently apply to the brain over every other organ; though of course it is most liable to disorganization from causes, whether of an opposite character or not, that act directly on its peculiar functions of thought and intelligence. Mr. Prior doubts if *trepining* the vertebræ is ever admissible; and also conceives that when we take into consideration the immediately exhausting and depressing effects of injuries to the spine, as in fractures of the spinous processes, &c., to wit, the slow and low pulse, the greater or less degree of paralysis of the bladder, bowels, and lower limbs, while a rotating motion only may be retained in these last, and the sensibility on their surface and extremities be acutely augmented, that the common practice of depletion by venesection with cupping and counteraction, is probably wrong in principle and often greatly injurious. A more generous course of food and stimuli, without omitting occasional cupping and counter-irritants, has in some severe cases, (*Loc. cit.*), appeared to promote more rapidly the restoration, partial at least, of the functions of the body.

The danger of Abscesses near the Vertebræ, is pointed out by Mr. Liston, (*London Lancet*, October 26, 1844, p. 121, &c.,) who mentions cases of abscesses in the cellular tissue behind the velum and between the posterior part of the pharynx and the vertebræ, which may involve and destroy a large portion of the vertebræ, so that death may instantly ensue from the head falling forward. The patient in these abscesses, from their stopping up the posterior nares breathes through the nose, and they must be opened in time. In the velum itself, in neglected sore throats, phlegmonous or otherwise, we may mention, that they form also, to a considerable size, that they are scarcely to be recognized by the eye, on the anterior portion of this pendulous fleshy septum. On applying the finger, however, the fluctuation is readily percep-

tible, when a free plunge of the lancet will cause the discharge sometimes of half a pint of pus, effecting the cure immediately. In the abscesses mentioned by Mr. Liston, he recommends not to defer the incision, which should be liberal, and in a dependant situation, for if left until they burst spontaneously, the patient may suffocate.

Fractures of the Vertebral Column.—M. Gaillard, of Poitiers, (*Journ. des Connaiss.*, &c., de Paris, December, 1842, p. 233,) in a memoir on this subject, in contradistinction to the opinion of most authors, believes that such fractures are most frequently produced by an indirect cause, that is, by a *violent and excessive flexion* of the vertebral column *forwards*; because the whole column is generally too much protected to be exposed, except in rare instances, to the *direct and local action and percussion* of wounding bodies; while the portion which is in fact most exposed, to wit, the spinous processes, are far less frequently fractured than the bodies of the vertebræ.

Another argument in favor of his opinion is, that the spine in consequence of the close adaptation and superposition of those processes, has but very limited movements of extension, while its lateral motions are equally circumscribed by the ribs. The movement forward is far more easy and natural; and where these motions are greatest, viz., in the cervical and inferior dorsal regions, fractures are most frequent; while in the middle dorsal region, though most exposed, all the processes are so completely interlocked together that fractures are extremely rare. The tenth vertebra from the peculiarity of the shallow articulating surfaces of its processes, constituting so marked a difference from those of the seven below it, and giving besides no attachment to the eleventh rib, is of course an exception, since it is remarkably exposed to dislocation.

The violent flexion which he supposes to be the cause of fractures of the vertebral column, is the result in the opinion of this surgeon of the sudden and violent efforts made by the person falling in order to save himself, whether he falls upon his feet, the tuberosities of the ischium, on the occiput or otherwise.

As connected with diseases of the vertebral column, which may result in fracture and dislocation of its constituent elements, we should perhaps here notice a new form of *Articular Torticollis*; described in (*L'Expérience*, of Paris, Sept. 17, 1840,) by M. Bouvier—who says it has its seat in the articulations of the first cervical vertebræ. The lateral articulations right or left, of the first cervical vertebræ, and especially of the atlas with the axis, (or second vertebra,) are the focus, and the disease consists in a peculiar form of inflammation of the synovial capsule, and fibrous tissues of these articulations. The essential characters are: 1, A position of the head and neck similar to that produced by contraction of one of the sterno-cleido-mastoid muscles, namely, lateral flexion to the right or left, and rotation of the face to the opposite side. 2, A pain felt towards the top and sides of the nape of the neck, sometimes on the lateral and posterior parts of the cranium; arising spontaneously, or in the movements of the neck. 3, Complete relaxa-

tion of the sterno-cleido-mastoid of the affected side, and equal tension of the muscles of the neck, both left and right. 4, Stiffness and pain in all, or any of its movements, notwithstanding the preservation of the articular connexions of the cervical vertebræ, and the integrity of the muscles. 5, Absence of swelling and of sensibility on pressure. 6, Atrophy or arrest of development of the side of the face, which corresponds to the inclination of the head, when this has lasted a certain time.

There are two states of this disease, acute and chronic. It is often produced by cold, sometimes by sudden distension of the ligaments. The sub-cutaneous section of course could not here be practicable, but it is important in the diagnosis to distinguish it from cases that may be benefited by the tenotome. (See *British and Foreign Med. Rev.*, 1841, p. 250.)

In connection with this subject, we perceive some recent remarks on a peculiar affection, denominated by Dr. Zink, of Vienna, the *Sigmoid Contortion of the Vertebral Column*. (See *British and Foreign Medical Review*, April, 1845.) He considers this contortion of the column to be most common in children of the wealthy. The seat of the disease is near the curve in the upper part, and to the right of the column, not in that of the basilar region, which is the result of the first. For the child, from the strength of the *respiratory* muscles on that side, which he deems the chief agents in producing the curvature, will constantly incline its head towards the right shoulder blade, and hence the pressure on the left lung, this being the weak side. This position, which is perpetually renewed at night in sleep, finally destroys the action of the left lung, and respiration is wholly performed by the right. In the cure the great difficulty is to maintain an antagonist pressure to the diseased side during sleep. He has by perseverance in this treatment, and by encouraging singing, also gymnastic exercises, to bring the left side into action, obtained success.

Caries of the Costo-Chondral and Costo-Vertebral Articulations.—A very interesting memoir, which appertains more particularly, however, to pathological than to operative surgery, but which should be read by the student, is to be found in the *Gazette Médicale* of Paris, (Jan. 4, 1845, p. 1, and subsequent numbers,) by Professor A. Toulmouche of Rennes, (France, and pupil of Laennec,) on the *Diseases of the Costo-Chondral and Costo-Vertebral Articulations, with or without Tuberculous Ramollissement and Necrosis of the Bones of the Vertebral Column*. The cold encysted abscesses and fistulous passages which such diseases give rise to in the neighborhood of these articulations, involving also the vertebræ and ribs, and their slow formation and obscure symptoms, render the diagnosis in such cases exceedingly difficult. The result, too, of such degeneration is generally fatal. Whether operative surgery could be usefully applied to such cases by the free dilatation of such abscesses or passages, and the trephining and exsecting of the diseased portions of the bone, is left for the skill of future practitioners to determine. It would seem to us, however, very natural that the easy

use of such means, which we see in the present advanced state of *conservative* surgery, employed with such admirable results in the exsections of carious small bones, as of the jaws, clavicle, carpal, metacarpal, and tarsal and metatarsal bones, (see our note on Exsection of a Carious Portion of the Os Calcis,) might prove eminently beneficial also if directed upon the ribs, vertebræ, and sternum.

Cure of Spina Bifida.—*Conservative surgery* will owe much to M. Dubourg, physician of the hospital of Marmand, (France,) if the two remarkable and radical cures of *spina bifida* effected by him should establish the new pathological views he has suggested in respect to this hitherto formidable affection, and upon which his successful treatment was based. M. Dubourg conceived, very naturally, that the superincumbent soft tissues would have much to do with the approximation of the boney edges of the congenital deficiency in the spine; and no doubt, recollecting the flexible gelatinous character of the boney tissue in early infancy, to which period of life this congenital disease belongs, considered that the soft tissues might be employed to modify or complete this approximation, as they frequently do in cases of hare-lip. Accordingly, in two infants, one only 8 and the other 11 days old, M. Dubourg, after making an elliptical incision at the base of the tumor in the lumbar region, and which tumor in each case was pediculated and about the size of an apple, with its duct placed on and communicating with the spinal marrow at the hiatus where the processes and body of the vertebræ were wanting, removed the tumor in each case, by which means an opening was made into the spinal canal, and a very large quantity of the serosity of the same, of a reddish color, discharged. After this, the lips of the wound were immediately brought firmly together by four pins and strong-twisted sutures applied around them, the points of the pins being separated from the integuments by small compresses, and the whole sustained by strips of adhesive plaster and a body bandage. In four days the pins and sutures were removed, the strips of plaster only being left on the parts. In fifteen days, the cure was *complete*, presenting a strong rose-colored cicatrix, forming over the spinal opening a solid protection, (bouchon.) (See *Gazette Médicale de Paris*, 1841; and *Journ. des Connaiss.*, &c., de Paris, Octobre, 1841, p. 168-169.) T.]

CHAPTER III.

BONES OF THE LIMBS.

There are scarcely any regions upon the limbs, to which the trephine was not formerly applied. At present, it is an operation more and more neglected, and one which the new saws will perhaps ultimately render completely useless.

ARTICLE I.—LOWER LIMBS.

§ I.—*Bones of the Metatarsus and Metacarpus.*

The surgeon not having at command (*dépourvu*) the articulated or rowel saw, or Liston's scissors, and being under the necessity of excising one of the bones of the metacarpus or metatarsus, might make use with advantage of a small crown of the trephine, which he would apply upon the continuity of the bone, after it had previously been denuded upon its dorsal surface. It is in this way M. Wardrop proceeded, a long time since, for the head of one of the bones of the metacarpus, and it is the course that might still be adopted for the anterior extremity of the first bone of the metatarsus.

§ II.—*Bones of the Tarsus.*

Certain circumscribed points of caries or necrosis existing upon the cuboid bone or os calcis, might equally be removed by the crown of a trephine, better than by any other mode. [See a note on this subject under Exsections, *supra*. T.] If the disease were deep, and the soft parts altered only by a simple fistula, then the operation would require a crucial incision on the dorsal region of the cuboid α one and the plantar region of the os calcis, which, with the other precautions indicated under the head of Exsection of these bones, (*supra*), would complete the manual.

§ III.—*Bones of the Leg.*

Trephining has often been employed for the bones of the leg. It has been used upon the tibia and fibula, and on the malleoli and near the knee.

A. *Tibia*.—The tibia, more than any other part of the skeleton, is exposed to necrosis and caries. I have already described in what manner we operate upon it for those two maladies by means of exsection. I will add only a word on the employment of the trephine in such cases. Scultetus, (*Arsén. de Chir.*, Obs. 81,) who states that he trephined the external malleolus, on another occasion applied two or three crowns of the trephine, and was thereby enabled to remove almost the whole of a necrosed tibia. To Cullerier (Obs. communicated by the author to M. Champion) we are indebted for a similar fact. Sequestra, of four or five inches extent, have been laid bare in three cases by M. Champion, (communicated by the author, 1838,) by means of two or three crowns of the trephine. The division of the soft parts, and the denudation of the hypertrophied bone, are performed in both cases after the same rules. If, after this stage of the operation, the trephine was to be applied in the manner of a saw or osteotome, we would first place one of its crowns upon the most depending fistula in the bone, then another

on a line with the one (fistula) highest up. It might afterwards be advantageous to apply several of them in the interval between the two first, in order to isolate the sequestrum completely. In two patients of M. Jobert, (*Journ. Hebd.*, 1836, p. 21,) who ultimately recovered, seven were required in one case and four in the other. We may, however, diminish the number of these crowns, by evulsing the bridge left between the first, either by means of the crested saw, directed (*portée*) from the exterior to the interior, or by an articulated saw passed through the osseous canal to the exterior, or by means of the concave rowel saws, the gouge, or the chisel.

In conclusion, if there were true necrosed sequestra, I do not think that the trephine would in any case here be preferable to the excision which I have described. Upon the supposition that there were only osseous fistulas in the tibia, kept up by a false mucous membrane or by caries, we could on the other hand, include the morbid track of the bone in the crown of the trephine, and remove it by a single stroke. A patient whom I saw and who was treated in this manner by M. Monod, did very well.

An abscess in the substance of the bone, or in the medullary canal, which has been several times seen by M. Brodie, (*Arch. Gén.*, 2e série, t. I., p. 101,) and which I myself have once met with in the first bone of the metatarsus, should equally be laid open by the trephine. Boyer, (*Journ. des Nouv. Découv.*, 1681, t. III., p. 504,) had already proved this in 1669. Muralt, (*Obs.*, etc., p. 144,) furnishes another example of it. We are indebted for a third to Meckren, (*Observ. Méd.-Chir.*, exp. 72, p. 341,) and J. L. Petit, appears to have often trephined the leg with success for abscesses of the tibia. Michel, (*Journ. de Méd.*, t. LIX., p. 135, 1783,) was not able to cure an ancient caries of the same bone until he had trephined it in several places down to its medullary canal. A purulent cavity, which Faure, (*Mém. de l'Acad. de Chir.*, t. V., p. 828, in 4to, obs. 7,) mistook for a spina ventosa, was laid bare by him by the same operation. To Gooch, (*Gaz. Salut.*, 1775, No. XXVIII., p. 3,) is attributed the idea of trephining the tibia for an extravasation of blood in the interior of the canal of this bone, and V. D. Wiell, (*Manget*, t. IV., 2e partie, chap. II., p. 432,) did or saw done the same thing to relieve a contusion in the leg.

"When," says Pouteau, (*Œuv. Posthumes*, t. II., p. 106,) "in consequence of contusion of the bones, there is concussion (*ébranlement*) with effusion and serious accidents, the trephine is the only resource for giving exit to the cause of these difficulties. I have, on two occasions, made this application of the trephine with the most perfect success. In the first case, the anterior surface of the tibia was sufficiently compact, (*i.e.*, solid,) though swollen; *in the other I found it rotten*, (*vermoulue*,) though the integuments appeared sound. I removed this rotten portion, (*cette vermoulue*,) by means of the rasp, and desiccated (*desséchai*) the remainder with the actual cautery; but perceiving that the iron had not in any manner assuaged the pains, I applied on the day after a large crown of a trephine, and

this operation immediately put an end to the sufferings, [of the patient.] In both cases the cure was soon accomplished.”

Trephining of the internal malleolus, like that of the inner condyle of the tibia, is sufficiently explained by what I have said of exsection or excision of those osseous projections.

[*Trephining the Tibia for an Abscess in it.*—M. Moulaud, deceased, late surgeon of the Hospital of Marseilles, in the case of a youth, aged 12, (*Journal des Connaissances*, &c., Paris, Févr., 1844, p. 75,) with a swelling of the right leg, without any external redness, but accompanied with lancinating pains from the lower part of the tibia, diagnosed an abscess in the bone. He made a crucial incision at the lower third of the tibia, and trephining into the bone opened into a large abscess there, caused by necrosis. The patient recovered perfectly. T.]

B. *Fibula*.—We may apply the trephine upon the fibula, the same as upon the tibia, and with so much the more propriety, inasmuch as this bone acquires double and sometimes treble its natural size when it becomes the seat of an invaginated necrosis. We may also remove a portion of its continuity by means of the crown of a trephine as well as with the saw, when it becomes necessary to extirpate its lower or upper extremity or even its middle part; but it is certain that by using the modern saws, sectors and osteotomes, we no longer at the present time have occasion in such cases for the employment of the trephine. It would be only for certain cases of deep-seated and very circumscribed caries of the external malleolus, that we could still feel the want of it. Having, therefore, indicated the circumstances where the trephine should be preferred, in treating of exsection of the fibula, I will not recur to that subject on the present occasion.

§ IV.

When a necrosis exists in the centre of the femur, and the fistulous openings of the new sheath are too contracted, or cannot be enlarged by the rowel saws, the trephine may then be of some utility. Here, also, I have only to recal the rules which I have laid down under the article on *Exsections*, in relation to what concerns the division of the soft parts. The semi-lunar flap being raised up, we place a crown of the trephine at an inch above or below one of the principal osseous fistulas, so as to penetrate into the sheath which contains the sequestrum or the pus. A man, aged 33 years, had suffered a long time in his femur; a crown of the trephine was applied by M. Lynn, (*Gaz. Méd.*, 1838, p. 778,) at four inches below the great trochanter; an exit being thus given to an abscess in the medullary canal, and to some splinters of bone besides, the patient recovered. If that does not suffice, we are to divide, as I have already said of the tibia, the intervening bridge of bone by means of the crested or chain-saw. Upon the supposition that the sequestrum was too long or too voluminous to allow of our extracting it by the first opening, we must then recommence

in the same manner on another point, and break it with the *osteotrite* of Dupuytren, or make use of the gouge and chisel to evulse the projections which are in the way.

The great trochanter and the external and internal condyle of the femur, should be trephined, as has been said in the chapter on *Exsections*, should there exist a simple point (*noyau*) of caries, accompanied with necrosis or tubercles, and that the articulation was unaffected and the disease had extended to much greater depth than width.

§ V.—*Pelvis.*

I have already said, under the article of *Exsections*, that the hip bone (*os coxal*) has sometimes need of being perforated. Boucher, having laid bare the external iliac fossa, traversed the bone of the ilium by means of a crown of the trephine, and gave egress in this manner to the pus of an abscess which was situated in the interior of the pelvis. If a necrosed portion were confined between two plates of new osseous formation (*tissu nouveau*) in this region, as in the patient of Léauté, and that we had ascertained its mobility by means of a probe, some crowns of the trephine might also assist in laying it bare. A semilunar flap, with its free border below, and raised up to the crest of the ilium, would enable us in both cases to come down to the bone. If, however, the disease in question were an internal abscess, or some carious points of bone, without hypertrophy or sequestrum, it would perhaps be better then to confine ourselves to a simple crucial incision.

Coccyx.—Sprengel states, that in a case in which there was an abscess in the pelvic cavity, Bilguer perforated the coccyx, or point of the sacrum, with the crown of a trephine, and thus cured the disease. I cannot, however, perceive the utility of trephining the coccyx in such cases; for it is easy to conceive that the bistoury could have reached the collection fully as well as the crown of the trephine, by penetrating upon one of the sides of the point of the bone, from below upwards, from before backwards, and from without inwards.

ARTICLE II.—UPPER LIMBS.

The different portions of the thoracic extremity are no less susceptible of the application of the trephine than the corresponding regions of the abdominal member.

§ I.—*Fore-arm.*

What I have elsewhere said of exsection of the radius and ulna, shows sufficiently what we may hope from the trephine when the bones of the fore-arm are diseased. The new instruments employed at the present time render it almost useless in this region. It would be moreover upon the postero-internal side of the ulna, or the

postero-external side of the radius, and after having made the proper incisions in the soft parts, that we would apply this instrument, should we be resolved upon using it.

§ II.—*Humerus.*

After the tibia, the humerus is perhaps of all the long bones the one that has been the oftenest trephined. Below the condyles, I would recommend the same as for the tibia, a semi-lunar and very long flap. This flap, by being detached from behind forwards, would incur the risk of dividing only a part of the fibres of the triceps, and could be crowded very far forwards with the biceps and vessels. If it were the upper fourth of the bone, the flap I speak of ought to have its free border facing downwards. As to what concerns, moreover, the placing and application of the crowns of the trephine, we should proceed as I have described for the tibia or the femur.

§ III.

The clavicle would not permit of the employment of the trephine unless it was enormously hypertrophied and enclosed a long sequestrum to be extracted; and even then the concave rowel, or the chain saw, or other species of osteotomes, would almost always deserve the preference to the trephine. In using the instrument, moreover, we should have nothing more to do after the flap had been cut than to raise it from below upwards, in order to lay bare the bone, after which it is to be applied as has been described above.

§ IV.—*The Scapula.*

It has oftener become necessary to trephine the scapula than the bones of the ilium. A soldier received a thrust through the shoulder from a foil; the wound remained fistulous; an ulcer formed in the infra-scapular fossa, and the pus made its escape therefrom but very imperfectly. Mareschal, who decided upon the step of placing the crown of a trephine upon the injured bone, cured his patient. In another case, where there was only a simple necrosis, Else of London also trephined the scapula, and was no less successful. A specimen deposited in the Anatomical Museum of Alfort, by Flandin, and which M. Cloquet states that he has seen; also two other similar specimens that M. Jobert professes to have examined in the same collection, would go to show that the scapula may be necrosed and imprisoned between the two plates of a scapula of new formation. [See notes *supra* on the Formation, &c., of Bones. T.] We may conceive how the application of the trephine under such circumstances might become useful; while we may at the same time comprehend that the operative process cannot be traced out in a book, and that it is left for each surgeon to devise his own, by adapting it to the particular case which he has under consideration.

I ought not, in terminating this article, to omit remarking that trephining of the bones of the limbs, like that of the bones of the chest, is in almost every case closely connected with what I have said of exsection or excision of the same parts. I will repeat that the employment of the trephine has lost much of its interest and importance in these regions, since the chain saw, that of Heine, and the rowel saws, now recognised in the domain of surgery, have given us the power of perforating and dividing the bones in the depth of the tissues with the same facility that the bistoury gives us in incising and dividing the soft parts.

Both for trephining and for exsection of the body of the bones in cases of chronic diseases, I have endeavored to generalize the semilunar form of the flap. The convexity of the free border of this flap, which is either slight or very marked, as the case may require, gives to the surgeon the extreme advantage of being enabled to lay bare the parts extensively by means of a single incision, and that of possessing afterwards every facility for contracting or closing the wound. It is a form which unites the advantages of the T incision, and that of the crucial and V to the simplicity of the straight incision. It is adapted also, as we have seen, to almost all the bones which are susceptible of exsection.

SECTION XII.

TUMORS.

Tumors form an extensive class of surgical maladies, even after having deducted from them, abscesses already treated of under the article on Elementary Incisions and Operations, [Vol. I.,] phlegmons and every kind of tumefaction, whether acute or chronic, which is undefined by any well-ascertained limits, and the principal medication of which consists of topical applications and internal treatment.

My design now is to speak only of tumors which are ordinarily treated by mechanical means or which are submitted to the action of instruments.

Considered in this point of view, tumors still occupy a large space in the departments of operative surgery. They are, moreover, too different in their nature, volume, causes and situation, to make it possible to treat of them at length in a general manner. Taken in their ensemble, they have been sometimes attacked with simple astringents or styptics, sometimes by compression or caustics, by strangulation, by ligature of the arteries which are distributed to them, or incision of the contour of their root, and sometimes by excision or extirpation; others have been treated by acupuncture or the seton, vaccination, crushing, (broiement,) or irritating injections and scarifications. As none of these numerous general methods can be suitable for all kinds of tumors, it would be useless in this place to give their rules in detail. Thus compression, which is useful in some cases of erectile tumors, would manifestly be inapplicable in cases of lipoma or exostosis. Crushing, which sometimes succeeds with synovial, sanguineous and lymphatic tumors, cannot be applied with advantage to scirrhus, elephantiasis, &c. Cauterization, which is not without efficacy in some species, would aggravate the disease in many others. Of what service would be a ligature upon the artery in a deep-seated lupus? Who would think of treating encephaloid tumors and neuromas by irritating injections? It is then in speaking of the principal kinds of tumor in particular that I shall have to consider the value, either absolute or relative, of the operations which are employed for them. On the other hand the classification of these tumors is exceedingly difficult. If the character of some of them would serve as a point of departure, it is not so for an infinite number of the others. If we take for our guide their situation, whether in respect to the tissue or the region of the body, we shall experience the same embarrassment, inasmuch as there are those which are developed almost indiscriminately, in all the organic systems, as well as upon all the regions of the body and at every depth of the animal economy.

As it is indispensable, however, to assemble them together in

certain groupes, I shall treat successively of tumors of the integuments, (tégumentaires,) those that are vascular, lymphatic, neuro-matic, lypomatous, hematic, synovial, osseous, elephantine and cancerous.

CHAPTER I.

TUMORS OF THE INTEGUMENTS.

Having already made some remarks on warts and corns, and certain other vegetations of the skin, under the chapter on Elementary Operations, I shall only have to speak here of horny productions, and certain fibrous vegetations of the tegumentary envelope.

ARTICLE I.—TEGUMENTARY TUMORS, PROPERLY SO CALLED.

It sometimes happens that the surface of the dermis becomes swollen and vegetates to such degree as to produce an actual tumor. So long as this tumor does not exceed certain dimensions, it belongs to the class of warts, and should be treated as has been already pointed out. If on the contrary it acquires a certain volume, that, for example, of a small nut, (noisette,) or of an ordinary nut, or larger still, it should be treated by one of the processes which I have just enumerated. In these cases the tumor presents several varieties. If it is diffused and imperfectly circumscribed, and that its limits do not yet appear to be determined, we must not attack it either by the seton, ligature or extirpation. Astringent and refrigerant topical applications, compression, or even cauterization, are manifestly the only suitable remedies.

When the tumor is clearly circumscribed or, as it were, pediculated, these last-mentioned remedies should be rejected, and our choice must lie between the ligature, excision, and extirpation.

§ I.

The *ligature* does not merit the preference in any case ; as, however, it answers the purpose when the pedicle of the tumor has but little volume, and that its root is in no respect degenerated, we may make use of it in timid subjects, or those who are badly constituted, (mal constitués,) and especially in such as dread above everything, the application of the bistoury. In such cases, then, we surround the pedicle with a ligature of silk or thread, and tighten it forcibly, and in such manner as to strangulate completely the vessels and other living tissues of which it is composed. The more sudden and powerful the constriction in such cases, the less

painful is the operation, and the more rapid and complete the successful issue.

§ II.

The *excision* of pediculated tumors of the skin, disembarrasses the patient of them immediately, and leaves a wound which generally cicatrizes with promptitude. This operation being speedy, easy, without danger, attended with little pain, and certain, is to be preferred as a general rule to the ligature. Before having recourse to it, however, we must make ourselves assured that the root of the pedicle is wholly sound at the point where it is continuous with the rest of the dermis. Otherwise, in fact, we should remove only a part of the disease, and the tumor would soon reappear. This excision is performed almost indifferently with any kind of cutting instrument. The surgeon, holding the tumor with one hand by means of the forceps or erigne, or causing it to be held by an assistant, readily cuts through the pedicle with a single stroke by means of a good pair of scissors or an ordinary bistoury. If it is small, he immediately cauterizes the wound with nitrate of silver, and has afterwards no need of any other dressing. The cure is generally complete when the eschar detaches itself at the expiration of a few days. If the wound should be larger, we should treat it like any other simple wound, and the cicatrization would not be long delayed.

§ III.

Nothing, moreover, would prevent us in such cases from combining *excision* with the *ligature*. The thread being applied, the tumor could immediately be effectually excised outside of it, inasmuch as it would cause no additional pain, and the patient would in this manner be disembarrassed of a mass, which, in putrifying, continues in some persons for about the space of a week, to be sufficiently offensive.

§ IV.

Extirpation of cutaneous tumors, nevertheless, is the only proper operation, when the alteration comprises the whole thickness of the skin at the point which serves as its root. Then it becomes important also to remove a certain portion of the sound tissues with the degenerated mass, (plaque.) For that purpose we make on each side of it a curved incision, so as to circumscribe a very long ellipse, the centre of which corresponds with the apex of the tumor. As it is unnecessary to penetrate deeper than the integuments, we stop at the sub-cutaneous tissue, and the operation is generally as prompt as it is easy. The wound which results from it is then treated by strips of adhesive plaster or by the suture, if we wish

to attempt immediate union. In the contrary case, we dress it flat by means of the perforated linen and a gateau of lint.

§ V.

A *process* which has appeared to me convenient when approximation by the first intention is to be attempted, consists in first perforating a fold of the skin under the pedicle of the tumor, with a sufficient number of pins while the tumor is being held up. These pins being once adjusted in their place, prevent us in nowise from proceeding to the excision in the manner just mentioned. They also allow of every facility in closing the wound, since nothing more is required than to pass a noose of thread around them in order to complete in an instant the twisted suture.

In these cases, moreover, as in others, the adhesive straps, needles and points of suture should be promptly removed, and replaced by emollient cataplasms, should there supervene the least appearance of erysipelas, whether simple or phlegmonous; better is it in such cases to take fifteen days in cicatrizing a small wound, than to incur the danger of diffused phlegmon.

ARTICLE II.—HORNY (cornées) TUMORS.

Horny productions have frequently been observed in man, in whom they present a form and dimensions exceedingly variable. There is no region of the body which has not been the seat of them; and the same individual might have a very great number of them at the same time. They have been noticed, and I myself have seen them on the cranium, forehead and mastoid regions. They often exist upon the nose, face and chin, and sometimes upon the lips. They have been encountered upon the neck, especially at the nape, also on the chest, belly, and sacrum, and about the genital organs. The limbs themselves are not exempt from them; they have been observed upon the shoulder, arm, elbow, fore-arm, and different parts of the hand. A horny excrescence resembling the enormous beak of a parrot, was successfully removed by M. D. Lassere, (*Cas. de Chir., etc.*, p. 42, fig. 5,) from the hand of a man who was eighty years of age. The same productions are found also upon the breech, thighs, legs and feet. An old man who died of an enormous cancer of the stomach, at the Hospital of La Charité in 1837, had the integuments upon his limbs so completely covered with them, that it was impossible to count them. There had been admitted some time previous into my department, (of La Charité,) a young woman who was precisely in the same condition, and I have collected two or three other analogous facts. In all these individuals the horny productions were exceedingly small; they resembled so many points, heads, nails, or pins implanted in the skin.

When these horny productions are multiplied in this manner,

there is no mode of submitting them to the processes of operative surgery. In such cases, if anything is to be attempted for the relief of the patients, we have no other resource but topical applications and general treatment, external or internal. In the contrary case, that is to say, when there is but one only, or a small number of them, when they are so large or elongated as to occasion inconvenience, and to induce the patient to demand their removal, these horns are to be attacked by the same processes as tumors purely cutaneous. Nevertheless, it is rare that they allow of our depending upon the ligature or simple excision. Being almost always deeply implanted in the dermis, they necessitate too powerful tractions upon them to allow of our placing a constricting thread upon the sound tissues behind them, [*i. e.*, deeper or below, or under their root.] The scissors or the bistoury also [in excision, *vid.* a few lines above. *T.*] would then divide the skin flat-wise, (*en dédolant*,) and produce a larger and more irregular wound, and one, consequently, less favorable to cicatrization, than that by extirpation. I should add that, in the extirpation of horny tumors, we ought, more even than in that of cutaneous tumors properly so called, to encroach (*empiéter*) at least to the distance of some lines upon the sound tissues, in order to be assured with certainty against every fear of a return. Though these tumors do not extend deeper than the skin except in some cases, they should be operated upon in the same manner in whatever regions they may exist. It could only be upon the cranium or face from the superficial position of certain arteries, that any particular precautions would become necessary. If they should penetrate to the muscles or bones, as has been seen in the thigh, or down to the dura mater, the surgeon would reflect seriously upon them before proceeding to their extirpation. But it is not required that I should describe this operation in particular, for the different regions of the body. I shall, however, be enabled to say a word in relation to it, in speaking of the other operations which are performed on certain complex organs, and there may be found in the Thesis of M. Danxais, (*Des Cornes*, in 4to, fig., Paris, 1820,) together with all the known examples of horny vegetations in man, a very just appreciation of the remedies which prudence authorizes us to employ in such cases.

CHAPTER II.

VASCULAR FUNGOUS OR ERECTILE TUMORS.

A class of tumors which has excited much attention among the moderns, is that which comprehends *navi materni*, spots, (*les envies*,) marks, (*seings*,) birth-stains, (*taches de naissance*,) *aneurism* by *anastomosis*, *erectile productions*, and *fungous sanguineous* (fon-

gueuses sanguines) tumors. These different names being employed to designate the same kind of morbid growths, (altérations,) have been almost universally superseded to-day by the title of erectile tumors, as proposed by Dupuytren, although this phrase is itself fully as objectionable as the others, (*Leçons Orales*, t. IV.) We understand by this, tumors or patches (*des plaques*) either of a reddish or of a more or less deep brown color. These productions, being composed of a net-work (*enlacement*) of vessels irregularly inter-laced and combined together, present some resemblance to the tissue of the *corpora cavernosa*. These erectile tumors, however, contain almost always a degenerate structure, (*une tumeur dégénérée*,) which essentially distinguishes them from the natural erectile tissues, and which predisposes them to transformations of a bad character. Nor is it rare also to encounter in them cerebroid or melanotic (*mélanique*) matter, and to feel embarrassed when called upon to decide, if the case in question is in reality one of erectile tumor or encephaloidal (*encéphaloïde*) fungus. It becomes requisite, therefore, to establish several varieties of erectile tumors.

ARTICLE I.—SPECIES.

§ I.—*Arterial Funguses*, (*Fongus Artériels*.)

The most common, namely, those which are observed more especially upon the surface of the skin, and which have been known for ages under the name of *stains*, *birth-marks*, and *navi materni*, depend almost always upon an unnatural dilatation of the arterial capillaries. So also are they generally of a bright (*vif*) red tint, and liable at moments to color deeper and become swollen to greater or less extent. Though erectile tumors in which the arterial capillaries preponderate (*à prédominance artérielle*) usually occupy the skin, they are however developed also in the interior of the limbs, and at the centre or surface of certain particular organs.

§ II.—*Venous Funguses*.

These, which from the very beginning acquire a sufficiently large size, and present a violet, livid or brownish hue, are more especially formed of veins, and are more frequently encountered underneath (*au dessous*) the skin, and in the depths of the tissues and organs, than upon the surface of the body. Usually flabby and crimped (*bosselées*) they readily shrink under pressure or in certain positions of the patient. To make them tense and to increase their size, we have only to incline downwards the part on which they are situated, and to maintain them in regard to the heart, in a depending position.

§ III.—*Mixed Funguses*.

Very frequently the arterial and venous capillaries so blend to-

gether, that it becomes impossible to avoid making a mixed species of such tumors, or to assign them to one of the preceding classes rather than to the other. In these the physical characters are necessarily a mixture (*mélange*) of those which I have just described. It is thus that with fungous and livid protuberances (*bos-selures*) upon them, there are noticed also patches of bright red which are hard and more homogeneous, and that by means of pressure or a certain position, they are in part flattened without having their color entirely effaced.

§ IV.—*Fungus Hematodes.*

So long as erectile tumors do not present other characters than those described, [ne sortent point de ce cercle, *i. e.*, as above detailed by the author. T.] their diagnostic is sufficiently easy. But if they become blended with tissues of a new formation, or with a more deep-seated degenerescence of their own elementary structure, we then have tumors which in part resemble encephaloid or melanotic or certain fibro-vascular tumors, and especially those which English practitioners have described under the title of *fungus hematodes*.

ARTICLE II.—TREATMENT.

Erectile tumors are not always situated in the same anatomical tissues of the body. At the surface of the body nothing prevents our attacking them by an infinite variety of surgical processes. Here we may recur to topical applications, compression, strangulation, vaccination, the seton, caustics, scarifications, the ligature, extirpation, &c. Underneath (*sous*) the skin they present more difficulties; astringents, caustics, vaccination, scarifications and the ligature, can no longer be applied to them, or at least with great difficulty. Deeper still, that is to say, between the muscles or in the thickness of those tissues, (*organes*.) compression itself, the seton, and injections, can afford scarcely any chance of success while incurring the risk at the same time of real dangers. Nothing then is left to have recourse to but extirpation, and some other processes of a very questionable efficacy. We arrive finally to those [erectile tumors] which are situated in the structure of the bones themselves, and which leave us no other choice but the removal of the limb or a ligature upon the principal arteries which are supplied to it.

These preliminary observations were necessary to enable the reader to understand what I am about to say of the boasted operations for erectile tumors. I should add before going any farther, that although there may be erectile tumors which might give rise to serious hemorrhages, as is seen in the case mentioned by Turner, (*Maladies de la Peau*, t. II., p. 242, trad. Franç.,) there are others, as those of infants, those that occupy the surface of the skin, or which exist from birth for example, which sometimes continue for

a great number of years without increasing in extent, or giving rise to any inconvenience. I have seen some which have ultimately wasted away (s'usur) and disappeared spontaneously. M. Ouvrard (*Op. cit.*, p. 385) mentions one which became inflamed and was thus cured. It becomes important, therefore, before undertaking their treatment, to ascertain with certainty, if they have a tendency to increase in growth, or that they have become so prominent at the surface of the skin as to give the child annoyance.

§ I.—*Topical Applications and Compression.*

A. Topical Remedies.—These local means made use of by M. Champion upon the strength of the advice of Abernethy, (*Surgical Works*, Vol. II., p. 322,) proved unsuccessful in a case where compression, if not a ligature upon the carotid, would have alone sufficed; and I have scarcely any more confidence in this means than I have in the application of the hand of a corpse (*la main d'un mort*), seriously recommended by Van Helmont, (*Tumulus Pestis*, etc.), as a remedy against erectile tumors, or *nævi materni*.

B. Compression.—Practitioners also are far from being agreed upon the efficacy of compression in the treatment of erectile tumors. Though Pelletan, Boyer, Abernethy and Dupuytren have obtained some advantages from it, J. Bell, M. Brodie and most other practitioners regard it as useless or injurious. The case cited by Boyer, of a *nævus* in which the tenderness of the mother effected a perfect cure in her child by holding her finger during several months, 7 or 8 times a day, transversely under its nose, is an exception which cannot serve for the foundation of a precept. The case in which M. Roux believes he succeeded, was not in reality cured, if I may rely upon the testimony of some ocular witnesses. I have seen a case in every respect similar to that of M. Roux; the same sex and the same situation in the disease; I prescribed compression, and a pelote bandage was prepared, but both the infant and the nurse became tired of it; nothing therefore was accomplished and things remained unchanged, (Champion.) Randolph and M. Roux, however, cite some other examples sufficiently conclusive in favor of compression. According to M. Récamier (*Revue Méd.*, Mars, 1831, p. 349) it effected the cure of a *nævus* which had become cancerous, after two ablations and cauterization had failed. It is moreover evident that this remedy cannot be suitable to all kinds of erectile tumors nor to all the regions of the body; those of the external surface of the dermis alone allow of its employment. Every thing indicates that it would not succeed in *nævi materni* composed of the venous capillaries; nor upon the abdomen, cheeks, breech, shoulder or elsewhere where the cutaneous patch cannot have a solid point d'appui, can compression be relied upon but with very little confidence. Should it be made trial of under an opposite condition of things, it would be necessary to continue it for several months with a perseverance which is rarely met with, nor would it then succeed once in fifteen or twenty times. As to the rest, the mode of effect-

ing it is by the ordinary compressive means, such as bandages, machines, collars, apparatus specially adapted to this object, &c. M. Champion has seen areolar or saccular sanguineous tumors under compression develop themselves to considerable extent below (au-delà) the skin, and acquire an elongated form and sometimes a very great size.

In conclusion, it is a method which cannot be proposed but where every other is impracticable, or in persons who cannot bear the mention of any operation which is really effectual.

§ II.—Vaccination.

A very mild remedy, but one which scarcely deserves any more confidence than compression, is vaccination. Many English surgeons, among them M. Hodgson, the same without doubt whom a certain journal designated under the name of Dr. Godgson, (*Clin. des Hôpitaux*, No. 97, t. II., p. 388, 1815,) as also MM. Earle, Dowing [Downing?] and Cumin, (*The Lancet*, 1829, Vol. II., p. 237,) were the first to extol this process for such affections. It is a method which I have made trial of, and recommended to many patients. An examination of the facts published in foreign journals, and those to which I have myself been witness, authorizes me at the present time to say, that vaccination may cure certain erectile tumors upon the cutaneous surface, whether arterial or venous; and that it even succeeded in a child whom I saw with M. Rayet, and who had a tumor of a mixed character of the size of a pullet's egg occupying the lower lip and one of the cheeks. But it is easy to comprehend, that if the disease were situated underneath the integuments, vaccination could scarcely have any effect (prise) upon it. It is suitable, therefore, only to external tumors, and to those of the mucous membranes which can be attacked upon the surface. The operation, then, requires that we should make a great number of punctures, whether internal or external, upon the entire surface of the tumor. It is important, moreover, that these punctures should not be over four or five lines apart. From the moment when the vaccine pustules begin to dry up, a considerable degree of tumefaction gradually takes place in the whole mass, which becomes heated and inflamed, and sometimes terminates ultimately in resolution. It would seem in such cases, that the vaccinal process induces throughout all the canals (vacuoles) of the erectile tissue, an adhesive inflammation, which prevents the afflux of fluids to the parts from being maintained, and definitively transforms the whole into a kind of solid and permanent (indélébile) cicatrix.

It is nevertheless true that vaccination will almost always fail against erectile tumors, and so much the more so, as it has no effect, it is said, upon patients who have been previously vaccinated, (Paral, *Archiv. Gén. de Méd.*, 1834, t. VI., p. 207.)

§ III.—*Cauterization.*

The necessity of destroying nævi, in consequence of their hemorrhage, or deformity, or the rapid progress which the disease sometimes makes, besides being susceptible of reproduction, and of becoming cancerous, for what reason is unknown, says J. Frank, (*Méd. Prat., trad. Franç., t. IV., p. 434, et suiv.*) in consequence of repeated cauterizations and irritations, nevertheless constantly brings back the mind of practitioners to the same means. The potential cautery, moreover, which answered in several cases cited by Turner, (*Malad. de la Peau, trad. Franç., t. II., p. 242*), F. de Hilden, (46 obs., 5e centurie; trad. Franç., p. 91,) and Muys, (*Nouv. Obs. de Chir., déc. 3, Obs. 1re., p. 155, trad. Franç.,*) has frequently been employed, moreover, to destroy what the bistoury had left.

Cauterization for erectile tumors, however, notwithstanding the recommendation of it which had been given by Callisen, (*Chirurgia Hodiern., etc., p. 204*), and the praises bestowed upon it also by M. Hodgson, M. Guthrie, (Tarral, *Op. cit.*, p. 98,) and M. Weller, had nevertheless been generally rejected from ordinary practice as a dangerous remedy. Boyer (*Malad. Chir., t. II., p. 395*) charges it with causing excruciating (atroces) pains, and of exposing the tumor to a dangerous degeneration. According to M. Bégin, (*Dict. de Méd. et de Chir. Prat., t. VII., p. 446*), it can scarcely have other effect than to hasten the development or the transformation of the nævus into a cancerous affection. Wedelius (*Prix de l'Académie de Chirurgie, t. V., p. 124, in 12mo*) relates that a nævus which existed in a girl, degenerated in cancer through the employment of nitric acid, (eau forte.) These objections, acknowledged by M. Maunoir, (*Mém. sur le Fongus Hém., etc., p. 87*), and restated by myself and others, have not prevented M. Wardrop (*Gaz. Méd., 1834, p. 711*) from employing this practice, and from endeavoring again to demonstrate its advantages. Encouraged by the successes of this practitioner, MM. Lawrence, Higginbottom, Lee, Langstaff, and some others mentioned by M. Tarral, have also used caustic, and all agree in justifying its employment. Defrance (*Thèse No. 267, Paris, 1835*) reports an observation which proves that M. Roux, receding (revenant) from his first opinion, has also since made trial of it. I have also used it in a considerable number of children, and it appears certain at the present day, that the fears of Boyer on the danger of caustics, in such cases, are not well-founded.

Cauterization, nevertheless, is only suitable to those superficial tumors, which are rather extended upon the surface than in depth, (épaisseur.) A child five years of age had a superficial and arterial tumor in the right ham. Repeated applications of potash ultimately destroyed it in a number of points; but perceiving that the disease increased in the same proportion upon the other side, it was deemed advisable to suspend the treatment. This child, who was subjected at a later period to a serious operation, died in

consequence of the reproduction of the tumor. Another child aged seven years, whom a student of medicine exhibited to me at the Hospital of La Charité, and whose right breech was covered with an erectile tumor as large as the spread-out hand, was also only partially cured by caustic potash, so that extirpation was resorted to, which ended in the death of the little patient at the expiration of a few days. A young man who had quitted the army, was admitted into my department, at the Hospital of La Charité, for the remains of an erectile tumor which appeared to have occupied an extent of from five to six inches of cutaneous tissue, between the ischium and fore-part of the right thigh. This man informed us, that while in his regiment he had been treated by caustic potash; but that new patches of tumors continued to be produced upon the outside of those which had been previously destroyed. Certain it is, that he now had remaining one from two to three inches long, and about an inch and a half wide, the surface of which was encrusted, and seemed to be the seat of the commencement of a cancerous transformation. A layer of zinc paste effected its separation; a regular cicatrix of good character was established underneath, and the cure finally accomplished.

The children whom I have treated with caustics, had erectile tumors which were situated in the interval between the eye-brows, and at root of the nose in one, on the side of the nose in another; the ala of the nose in a third and fourth, and on the fore-part of the chest in a fifth. The largest was not over an inch and a half in extent, and the smallest (*plus étroite*) was twice the dimensions of a small bean, (*lentille*.) In another child whom I saw with M. Rayer, and who had erectile tumors in the dorsal and sacral regions at the same time as upon the face, the potash also succeeded, though one of these tumors was several inches in breadth.

A. *Diffused Cauterization*, (*cantérisation en nappe*.) This operative process comprises two modifications: in one I use a piece of potash, in the same way as nitrate of silver. Having previously moistened the surface to be cauterized, I seize the fragment of potash, either with a forceps or the fingers protected by linen or paper, or after having secured it in a sort of crayon, I rub it upon all the projecting points and anfractuositities of the patch or tumor, taking care, it is understood, not to permit any of it to run upon the sound skin.

No dressing is afterwards necessary. As soon as the incrustation which results from this has separated, that is to say, at the expiration of from four to six or ten days, the same process is repeated, and so on successively, until there no longer remains any vestige of the morbid tissue. If the cicatrix should not have at the same time been formed underneath it, the wound is to be thence dressed like any other simple wound until the desiccation is completed. In this way we cause scarcely any pain, and four to five or six cicatrizations frequently suffice. This is what I should be disposed to call cauterization *en nappe*, and is the only mode I have been in the use of since 1837.

B. *Scattered Cauterization*, (Cautérisation disséminée.)—Others have adopted a different mode. Applying an indefinite number of grains of potash at certain distances from each other, either at the same time or successively, their object is to riddle (cribler) the tumor, so to speak, with small cauteries. After the fall of the eschars, they allow each ulcer to suppurate; these, in cicatrizing, prevent any reproduction of the erectile tissue beneath them. The potash applied in this manner by M. Tarral upon a tumor of the size of an olive, by M. Langstaff on smaller marks, by M. Langier, (Tarral, *Op. cit.*, p. 200–205,) on a uretro-vaginal tumor as large as a nut, by M. Higginbottom in many other cases, and by M. Allier, (*Journ. des Conn. Méd.-Chir.*, 1838, p. 188,) above the clavicle in an infant aged eight months, has always succeeded in the same way as with M. Wardrop. If any protuberances (bosselures) remain in the interspaces, they are to be treated in the same manner until they have all disappeared. This mode of cauterization is not only more painful but less convenient than the other. It does not succeed so well when the tumor is spread out (large) and thin (mince;) but it merits the preference for tumors with thick and unequal elevations, inasmuch as cauterization *en nappe* can never be but extremely superficial.

C. *Other Caustics*.—Perhaps, also, it would be advisable in this case, to employ the *zinc paste*, (pâte de zinc,) or Vienna caustic, in preference to potash. But this is a question of practice upon which time and facts do not yet allow of our giving a definite opinion.

I. The fear which had so long restrained surgeons, in respect to the dangers imputed to caustics, having been once dissipated, they soon had recourse to trials with other species of cauterization. Thus MM. Graefe, (Tarral, *Op. cit.*, p. 211,) and Guthrie, we see attack and cure certain superficial erectile tumors by means of *nitrate of silver*. Cauterization with nitrate of silver, says M. Champion, was the only method that could be employed in a new-born infant, in whom the *nævus* (seing) occupied the left ala of the nose, with the corresponding part of the lip; no trace of the disease was left behind, while an operation would necessarily have produced one. I should think indeed that *nævi materni*, which were but little extended and superficial, would often yield to this means. I have employed it on two occasions, with entire success for erectile *nævi* on the visage, which were only two or three lines in diameter. A young girl of eleven years of age, who had an irregular, slightly granulated *nævus*, of five or six lines' extent, below the great angle of the left eye, was cured in this manner by five applications of the nitrate of silver. But this kind of cauterization would inevitably be attended with no success, in cases where the patches were somewhat large or of a certain thickness.

II. Going from this extreme to the other, in respect to caustics, Dupuytren and some other surgeons have not hesitated to apply the *hot iron* to erectile tumors.

Though it may not be certain that Morin and M. Maunoir, who

quotes him, had recourse to this treatment at the very first, it is at least proved that M. Graefe has frequently made use of it, since 14 examples of it are related in one account alone of his clinique. For my own part, I am satisfied that the actual cautery which has been employed by M. Ouvrard as an auxiliary to excision, (*Observ. de Méd. et de Chir.*, p. 37,) would answer as well as chemical caustics; that we might make trial of it, therefore, with very considerable prospect of success in all cases of superficial erectile tumors; and that it would have the advantage also of enabling us to destroy at once both patches and projections, (bosselures,) which the potential cautery could only remove in succession. Nevertheless, it is still a remedy which is suited only to tumors upon the surface of the body; and since it has the inconvenience of inspiring great terror in the patient, and is far from always proving successful, and since M. Graefe himself states that he has seen it fail in five instances, and inasmuch as we may moreover obtain almost the same results with potash, or the Vienna paste, I am induced to believe that it will not obtain an extensive adoption in practice.

III. I cannot state to what extent, *butter of antimony, nitric acid, sulphuric acid*, and the arsenical pastes might be employed in these cases; but there is every reason to believe, that we might obtain the same results from them as from potash.

IV. Nor would perforating the tumor with *one or many red-hot needles*, (*aiguilles rougies au feu*), as is recommended by M. Bushe, (*Warren on Tumors*, etc., p. 418,) or introducing into its interior, through a track previously made for it by a seton, or some other instrument, a probe heated in the same manner as some English surgeons, and M. Macilwaine, (*Méd.-Chir. Trans.*, part 1st, p. 189,) among others, have done, ever become an effectual operation in such cases. [We think our author's judgment, for want of experience in the treatment with hot needles, is for once at fault, in the expression of the opinion just given by him. Experience, in this country, at least, has satisfactorily established the important fact, as we have shown in detail, in our notes in Vol. I. and Vol. II., *infra*, that the treatment by *red hot needles*, as so successfully practised by Dr. Mott and others, is by far the most efficacious and radical cure which has ever been attempted for ordinary superficial *nævi*, or even for those of larger extent, which rise to the elevation of half an inch or more above the surface. T.]

§ IV.—*Tattooing*, (tatouage.)

A German surgeon, M. Pauli, (*Rév. Méd.*, 1836, p. 253; *Journ. de Siebold*, t. XV.,) has recommended and employed a process, which, in a certain point of view, resembles vaccination. This method consists in a species of tattooing, with carbonate of lead. The object of the author is to change the red color of the erectile tissue, or *nævus maternus*, into a white spot. It is satisfactorily established, that by puncturing the skin with needles, which have been dipped in substances of different colors, we imprint upon it

marks that are perfectly indelible ; it is a fact, the truth of which the people of India, and French laborers and soldiers, furnish daily evidence ; but nothing shows that the patient has been in any respect benefited by the operation, though even his red patch should be superseded by a white one, and every thing leads us to infer that the tatooing of M. Pauli is incapable of changing the nature of erectile tumors.

§ V.—*The Ligature.*

The different kinds of ligatures have been applied to erectile tumors in the same manner as to all other excrescences which grow upon the surface of the skin.

A. *The Simple Ligature.*—When the tumor is pediculated, we may effectually strangulate its root circularly by means of a circular ligature. M. Walther, and M. Maunoir, and before them, A. Petit, (*Observ. Clin.*, p. 364,) have frequently succeeded in this manner. There is every reason to believe that the excrescences strangulated in this mode by Saviard, (*Nouv. Obs. Chir.*, p. 515–516, obs. 114,) in the daughter of a draper, and in his own niece, were also pediculated erectile tumors. They had, says Saviard, a large head and thin neck. This form is less rare than the statement of authors would lead us to conclude. A hatter of Paris had one of the size of an almond, in front of, and below the right ear, which held only by a small pedicle of two to three lines in diameter, and which it would have been easy to strangulate. I have seen a similar one on the neck of another patient, and near the pubis in a third. The only precaution to be taken in these cases, is to apply the thread solely upon the sound skin. We operate, moreover, precisely in the manner which has been described in speaking of tumors purely cutaneous. Erectile tumors, however, presenting themselves most frequently under the form of plates, (plaques,) are rarely susceptible of the application of the simple ligature.

B. *A Ligature traversing the Tumor*, (traversant la tumeur.)—In such cases another mode has been adopted. Bell (*Surgical Works*, Vol. I.—Tarral, *Op. Cit.*, p. 13) was one of the first who asserted that we might then pass a double ligature through the middle of the tumor, in order afterwards to strangulate each one of its halves separately with the corresponding thread. This kind of ligature, which is extolled by M. Warren, (on Tumors, &c., p. 417,) who constricts each fourth of the tumor, and the credit of which is given by M. Hutchinson to Allisen, (Tarral, *Op. cit.*, p. 13, Callisen?) and which is no other than the ligature so frequently employed by the ancients, has found sufficiently numerous partisans in England, and even in France.

M. White has used it with advantage, and M. Lawrence was indebted to it for four successful results in 1827. M. Brodie (*Gaz. Méd.*, 1835, p. 778) and M. Barton (*The Lancet*, 1829, t. II., p. 559,) extol it as one of the best processes that can be employed. It appears, moreover, that it has never been entirely laid aside by the

surgeons of the Hôtel-Dieu of Lyon. M. Bajard, (Bouchacourt, *Rév. Méd.*, 1838, t. III., p. 223, 234,) as well as M. Bonnet, have obtained strikingly successful results from it, and M. Gensoul (Perrod, *Thèse* No. 109, Paris, 1829, p. 39) had also already, in 1829, frequently succeeded with this method. Nevertheless, according to M. Turner, (*Arch. Gén. de Méd.*, 2e sér., t. VI., p. 13, 14,) it was attended with accidents sufficiently serious, and even convulsions, in the hands of MM. Lawrence and Averil. MM. Syme, Carlisle, and Guthrie, who claim the credit of the ligature for the hospital of Westminster, also declare that it is an excellent process. It is, besides, employed in several different modes: sometimes the ancient processes are followed; that is, the double ligature, passed behind the tumor, is immediately doubled again, while the erectile mass is drawn forwards as if to detach it from the body; a first half is then tied with one of the threads, in such manner as to strangulate it tightly, (solidement,) after which the same is done for the other half. As this belongs to a general method, it possesses nothing special for erectile tumors. It appears that Physick (Warren, *Op. cit.*, p. 419) tied erectile tumors only in portions and successively, at certain intervals.

C. *Ligatures under Pins*.—Others, after the manner of M. Gensoul, (Perrod, *Thèse* No. 109, Paris, 1829; Bouchacourt, (*Rév. Méd.*, 1838, t. III., p. 235,) perforate the base of the tumor with a long needle or with a pin; then pass a thread under the extremities of this pin, in order to strangulate the tissues behind, in the same way as I have described under Varices. There are others, finally, who, like M. Brodie and M. Barton, (*Gaz. Méd. de Paris*, 1835, p. 778,) or M. Keate, employ, instead of one pin, two pins crossing each other (en croix) as in the process of M. Davat, with the view of strangulating with more certainty all the tissues in which it is desirable to produce mortification by means of the thread passed underneath.

The same principle governs all the modifications of the ligature. Provided the needles or threads pass through the *sound* tissues, that the constricting ligature makes its pressure upon the undegenerated skin, that no portion (plaque) of the erectile tissue escapes behind it, and that the strangulation is sufficiently complete to arrest all circulation in the parts, the operation will be well performed. So that the simple ligature, or a single pin or two pins crosswise, are nothing more than varieties demanded by the form or extent of the tumor, or the particular fancy of the surgeon.

Whatever may be the mode employed, the ligature, in other respects sufficiently painful, is suitable only, or inapplicable except, to tumors which are purely cutaneous, accurately circumscribed, and little extended in surface, and which project considerably from the skin. More efficacious than vaccination, compression, tattooing, and mild caustics, it is less convenient, more painful, and more restricted in its use, than cauterization with potash, the Vienna paste, or the hot iron.

§ VI—*Prolonged Acupuncture.*

Since the attention of practitioners has been drawn to the treatment of erectile tumors, it has been proposed to apply to them most of the means which I have recommended against varices. The facts which authorized me to say, in 1830, that needles or other foreign bodies, left for some days through blood-vessels and aneurismal tumors, would effect their obliteration, have become the point of departure for many new processes. A certain number of pins or needles, passed from one side to the other, at proximate distances and in various directions through the tumor, where they may be allowed to remain from eight to fifteen days, have unquestionably effected the cure of certain *nævi materni*. M. Monod and myself employed them, in 1834, on a child aged eight months, who had an erectile tumor of a mixed character and larger than the fist, situated upon the cheek and the parotid region. Fifteen long needles were first introduced and left there; at the expiration of some weeks, they were replaced by fifteen small setons, and the same process was several times repeated during the course of the year. The tumor, which up to that time had developed itself with so much rapidity, ceased at first to increase. Beginning to diminish soon after, it ultimately became so reduced as to form only a nucleus or irregular patch in the thickness of the cheek. At the present time, (January, 1838,) the child remains perfectly cured. M. Lallemand, (*Arch. Gén. de Méd.*, 2e série, t. VIII., p. 17,) who, without doubt, was ignorant of my first experiments, has cured an erectile tumor upon the shoulder by means of *one hundred and twenty needles*. Forty at first, and then fourteen, passed in this manner through the tumor, also equally cured a patient spoken of by M. Nichet, (*Gaz. Méd.*, 1836, p. 459; *Rév. Méd.*, 1838, t. III., p. 237.) Nevertheless, a girl aged from ten to eleven years, whom I saw with M. Sanson, and who had a venous erectile tumor upon the eye-brow, derived but very little advantage from this operation, which also did not succeed any better in a child whom I saw with the same practitioner at M. Rayer's. M. Bouchacourt also (*Rév. Méd.*, 1838, t. III., p. 237,) speaks of two patients who had submitted to it without success, at Lyon, in 1837. It would be wrong, in fact, to exaggerate its efficacy. Incapable of effecting the cure, except by inflaming the canals or sinuses (vacuoles) which compose the tumor, this method exacts a considerable number of needles, and that all the tracks traversed by these foreign bodies should afterwards become effectually obliterated. We may, therefore, conceive that, in a certain number of persons, fragments of the vascular tissue must escape in spite of all our efforts, and would thus continue to keep up the disease. Acupuncture, performed by this mode, would not probably be attended with success, except with tumors that were more projecting than extended, with large meshes (*à mailles spacieuses*) and a tissue really fungoid. So also is it a method which is scarcely suitable to *birth-stains*, or to

erectile tumors that are purely tegumentary. An infant of fifteen months, who had one of these tumors at the root of the nose, was only half cured by the passage, thrice repeated, of seven to eight needles. Caustic potash was employed by me, at a later period, to effect the cure. [It is gratifying to perceive that our author, so long since as this edition was published, (1839,) had formed a just appreciation of the general insufficiency, in *nævi*, of this favorite, original, and triumphant process of his for *varices*, by transfixing with needles. It will be seen, by our notes below, that the practice in *nævi* is at the present time still more generally discredited, and yet that it closely infringed upon, and approximated to, and doubtless actually led to the truly efficacious, *if not almost always radical cure*, of all *nævi* of every description, deep-seated or superficial, to wit, the application, *once or twice only* (see our Vol. I.) and for a few moments successively, of some half-a-dozen *red-hot* needles, instead of *a hundred or two hundred cold ones*, during the space of a year. T.]

§ VII.—Setons.

The idea of passing a seton through erectile tumors, which is generally ascribed to M. Fawdington, (*The Lancet*, 1831, p. 162; Tarral, *Op. cit.*, p. 207,) is one which, if we are to believe M. Tarral, (*Arch. Gén. de Méd.*, 2e série, t. VI., p. 207,) MM. Lawrence, Macilwaine, and Langstaff, have frequently made use of (*Lond. Med. Rep.*, Nov. 1822) with apparent success. The seton had been employed ten years before, by another English surgeon, (*Gaz. Méd. de Paris*, 1834,) for a tumor which was of the size of an egg. Mr. Lawrence, in a case under his care, perceiving that the seton caused scarcely any inflammation, withdrew it from the tumor after the expiration of a few days, in order to besmear it with nitrate of silver, and to re-introduce it into its primitive track. External cauterization, nevertheless, became necessary to complete the cure. In the patient of M. Macilwaine, the seton brought on a very violent inflammation, and a suppuration which continued for thirty months. M. Michel also states that he has used the seton upon one occasion; but every thing shows that his patient was affected with a fibrinous tumor at the knee, and not an erectile tumor. The few facts published on the employment of this resource, show that it never will, in reality, constitute the remedy to be depended upon (efficace) for erectile tumors. The use hitherto made of it, only proves that these tumors may be transfixed by foreign bodies, with less danger than had at first been anticipated.

§ VIII.—Numerous (multiples) Setons.

Setons applied to the number of several, in the manner I have said with pins or needles, have been attended with some advantageous results in six of my patients. By means of a common and straight needle, if the case is one of a small external tumor, a spear-

shaped needle curved at its point, for tumors of a certain diameter, an ordinary curved needle for sub-cutaneous tumors, or those which are found in any deep excavation, I introduce three, six, ten, fifteen or twenty threads, through the tumor in all directions, so as to perforate it at every point. I take care that each of the points of thread represents a large free noose, which is afterwards cut through in its middle. The two ends of each respective, (correspondant) seton being tied into as many circles which may be made to turn easily in the tumor, the free portion of all those rings, fixed above by means of adhesive plaster, is detached from the latter, the day after, in order that the surgeon may act upon them with a movement backwards and forwards, and make each one of them glide through the portion of the tumor it has traversed. We repeat this each day until the whole of the sanguineous mass is actively inflamed which will happen about the end of the first or second week. I withdraw then all the threads, and the employment of topical applications at first emollient and then resolvent, will suffice to calm the inflammatory movement they have occasioned. When the tumor is no longer heated or painful, or that it ceases to diminish, we may, if there still remain in its interior any spongy portions, which do not appear to be obliterated, traverse it again in every possible direction with another series of setons.

It may be required thus to renew this application four or five times. Each seton having no other effect than to transform into compact tissue the track which it has passed through, we may readily conceive that it may become useful to insert an infinite number of them successively through certain erectile tumors, and that the success of the operation will not be complete, so long as the threads shall have suffered to escape the smallest lobule of the sanguineous production.

In conclusion, the treatment by numerous setons is not suitable to erectile tumors that are flat and superficial. Those which occupy the lips, interior of the mouth, and different regions of the face, and the sub-cutaneous tissue, will find in this resource a remedy truly efficacious, so long as they are made up only of vascular branches that are regular, or that are of a small volume. In the cases of tumors with larger canals, (vacuoles,) and those that are voluminous and deeply-situated, it is better to recur to other methods. In a young lady whom I saw with M. Marjolin, the tumor obliged me at a later period to have recourse to extirpation. Setons also are to be rejected where the tumors are already anfractuous, (bosselés—vid. supra,) hard and painful, or where there is the least appearance of cancerous degenerescence.

§ IX.—*Suture.*

If in place of confining ourselves to the form of a seton, we should perhaps succeed better if we were to change the operation into a spiroidal suture, (en suture spiroïde,) by means of long threads. Interlacing, (entre-croisée,) the tumor in all sorts of ways, this

suture would combine the action of the seton to that of the ligature or strangulation, and would present thus greater chances of cure. It is a method in my opinion, which deserves a trial.

§ X.—*Crushing*, (broiement.)

The idea of breaking up, (de broyer,) erectile tumors, seems to belong to M. Marshal Hall, (*Lond. Med. Chir. Journ.*, Vol. VII., p. 577;) but it is M. Hening who first put it in practice. The case was one of a tumor of half an inch in diameter; the surgeon plunged into it at one of its borders a cataract needle, and thus traversed it in eight or ten different directions without withdrawing the needle or touching any other point of the skin. A slight compression prevented all hemorrhage, and no accident supervened.

The cure not having been effected until at the expiration of six months, creates in reality a doubt as to the efficacy of this remedy, though M. Hall asserts (Farral, *Op. cit.*, p. 211,) that he has since effected several other cures from it. We could in fact comprehend that certain tumors thus broken up in their interior, might be resolved, and become absorbed, (se disparaître,) especially if compression and topical astringents were associated with the *broiement*; but it is extremely probable also, that others might resist this mode of treatment, be transformed into a sanguineous depot, or abscess, and give rise under its influence to some serious accidents.

For superficial tumors, then, *broiement* offers fewer chances of success than canterization. For deep-seated tumors, it is not as good as numerous setons.

§ XI.—*Injections*.

If every erectile tumor consisted only of a cavernous mass, whose tissues freely communicated with each other, the idea of injecting a liquid into it, would be very natural, and might lead to a method as efficacious as it would be simple. We have seen, however, that the fact is not so, that sufficiently often these tumors are formed of large canals, [vacuoles—or large varicose arterial or venous dilations T.] and of grumous clots, (grumeaux) and sinuses, (cavernes, or cavities,) or small vessels, altogether independent of each other in their calibres.

A. M. Lloyd.—Nevertheless, as the cavernous arrangement cannot be called in question in some of these tumors, the processes of injection ought not to be rejected without examination. M. Lloyd, (*Gaz. Méd.*, October, 1836,) who was the first to extol irritating injections, viz., in 1828, made use of a mixture of three to six drops of nitric acid, to a gros of water. By several times injecting this liquid into the tissue of the tumor, by means of an Anel's syringe, while compression was established around, in order to protect the sound parts, he completely cured his patient. M. Bell had equally succeeded, in following the same method; but M. Toogood, and

M. Ward, in 1834, wrote to M. Farral, that they had made trial of M. Lloyd's injections without success.

B. The *Author*.—For myself I should not hesitate in injecting sub-cutaneous tumors, by employing a larger sized syringe, and tincture of iodine, in place of solution of nitric acid. If, as many facts induce me to believe, this tincture infiltrated through the tissues does not mortify them like wine, (le vin,) it would I am sure cause the disappearance of the cavernous or areolar form of a good number of these erectile tumors. Having made a puncture with a cataract needle on one of the points of the circumference of the tumor, I would introduce therein the beak of the syringe, and then throw up the injection with a certain degree of force. Repeating this injection as often as would be required for the liquid to arrive at all the *vacuoles*, I would obtain either an adhesive inflammation or suppuration which would offer a like number of chances of success. There would in fact be no reason why, if the tumor were voluminous and deep-seated, we should not make use of the trochar, and proceed as in the operation for hydrocele. [See notes infra—also supra, under Veins. T.]

§ XII.—Incisions.

Sanguineous tumors, however, which bleed upon the least handling, or from the slightest abrasion, have in some cases been attacked successfully by large incisions. The following is the plan which was adopted by an anonymous author, (*Gaz. Méd.*, 1833, p. 321,) who communicated his observation to one of the Journals of Berlin. A child had a large sized tumor upon the temple: the surgeon having slit up this tumor deeply throughout its length, emptied it by means of fine pieces of sponge of all the blood which could thereby be expelled from it; pieces of linen folded being then introduced into the wound, allowed of making compression over the whole of it, which ultimately resulted in a cure. The author regards this method as one that is very effective and of an easy employment, especially where the subjacent tissues render the compression supportable. M. Lallemand, (*Archives Générales de Médecine*, 2e série, t. VIII., p. 8, 14,) had imagined something similar in 1835. After having excised a slice of the tumor, or simply slit it up at various points, this practitioner united the wounds by means of the twisted suture, and was thus enabled to cure two of his patients.

The facts of this kind published up to the present time, prove that there has been too much apprehension of hemorrhage from the action of surgical instruments on erectile tumors, but they do not demonstrate that a simple incision suffices to cure this kind of disease. A sacculous (sacciforme) nævus (*Eph. Nat. Cur.*, Dec. 2 an 6, p. 688, Obs. 199; *Coll. Acad., partie Etrang.*, t. VII., p. 476) which was situated in the mouth, and which was laid open, gave rise to a fatal hemorrhage. We should succeed better, no doubt, by multi-

plying and crossing (*entre-croisant*) the incisions, so as to divide the tumor on a large number of points; but then the operation would be more serious than excision, properly so called, and we should rarely obtain other results than those we might reasonably hope for from multiplied setons or the suture. No one, moreover, would probably venture to attack in this manner voluminous erectile tumors, or those which exist at a certain depth in the natural cavities or in the body of the limbs.

§ XIII.—*Ligature of the Arteries.*

As erectile tumors result from vascular exuberance, it has suggested the idea that the remedy above all others for arresting their development and for destroying them, would be to obliterate the vessels which go to or come from them. From whence has arisen a method which comprehends many modifications. Some surgeons have limited themselves to deep incisions upon the sound tissues around the tumor; others isolate each artery in the neighborhood and immediately apply the ligature to it; there are others again who lay bare the principal arterial trunk of the region without troubling themselves with those of the tumor itself.

A. *Incisions around the Contour (du pourtour) of the Tumor.*—In a patient affected with an erectile tumor upon the right fore-finger, and whom M. Hodgson had without any result subjected to a ligature upon the radial and ulnar arteries, M. Lawrence (*S. Cooper, Dict. de Chir.*, p. 170) incised the whole contour of the root of the finger, when the tumor disappeared. Physick (*Dorsey, Elements of Surgery*, Vol. II., p. 273) had successfully made trial of something analogous a long time before. If the tumor were too large, perhaps it would be advisable to imitate M. Gibson, (*Ibid.*, p. 272,) and to surround it only successively, that is to say, incise at first the third of its circumference, to do the same at the expiration of eight or ten days on another third, and so on till the operation was finished. Except, however, upon the fingers, and when the tumor is large and flattened, we cannot perceive the advantages of this method over extirpation properly so called, and every thing goes to show also that the ligature upon the neighboring arteries would attain the same result. If, however, we should decide upon doing it, it would be necessary to take care and direct the bistoury perpendicularly upon the sound skin, as in simple incisions, and not to fail in penetrating down to the aponeurosis; all the arteries should be tied successively as they are opened, and small *rouleaux* of lint afterwards placed in the wound to hold the lips apart. We thus perceive that it would be dangerous to apply this method elsewhere than to erectile tumors upon the cranium, some regions of the face and fingers, or to the dorsum of the foot or hand.

B. *Ligature upon the Small Arteries.*—Nothing could be more rational than the idea of destroying erectile tumors by tying the arteries which are distributed to them; from whence it happens that this is an operation which can now count a great number of

trials. Unfortunately it is one also which has frequently resulted in failure. A surgeon mentioned by Bell, successively tied the temporal and angular artery, for a tumor which occupied the upper eyelid. A cure did not take place, and Bell was obliged to proceed to the extirpation of the fungus. It is also said that in the case of a tumor situated upon the forehead, the ligature applied to the arteries in the neighborhood by M. A. Cooper (*The Lancet*, 1829, t. II., p. 559) did not prevent the tumor from progressing. M. Brodie in a case succeeded by means of two needles placed crosswise and a strong ligature. M. Roux tied the labial, facial and transverse arteries for a fungous tumor of the cheek and upper lip. The compression also used at this first operation, brought on inflammation and a slight degree of suppuration. The tumor appeared to diminish in extent, but at a later period extirpation had to be resorted to. A strong robust tanner, aged about thirty, had the entire upper lip transformed into erectile tissue of a vinous or violet color. I applied a ligature to the upper coronary artery, first on the left side and four days after on the right side. To be more sure of letting no arterial branch escape, I had taken the precaution to incise through the whole thickness of the lip vertically from a line with the ala of the nose, to the vermilion border below, (*jusqu'en bas.*) Having tied the two ends of the artery, I united the wound by suture as in hare-lip; I proceeded precisely in the same manner for the second operation as for the first. During about the space of fifteen days, the lip grew paler, and sensibly diminished in thickness; but it soon became the seat again of pulsations, and ultimately resumed the state which it was in before the operation. Pelletan, who after the surgeon mentioned by Bell, appears to have been the first who made trial of the operation in question, in order to arrest the development of an erectile tumor upon the cranium, cheek and ear, proceeded, after having tied the temporal artery, to apply his ligature also upon the occipital. Successive hemorrhages came on and the patient died on the fourteenth day. A patient operated upon by Dupuytren (Hodgson, *Traité des Mal. des Artères*, p. 300) for a similar tumor, had also undergone without success a ligature upon the temporal, auricular and occipital arteries. I have elsewhere said (*vid. supra*) that the ligature upon the small arteries had also failed in the hands of M. Brodie, M. Syme, (*The Lancet*, 1829, p. 596,) and many others. A ligature applied by M. King (*Tarral, Op. cit.*, p. 24) to the temporal artery, for a nævus on the upper eyelid, also failed to effect a cure.

It is therefore one of the most uncertain operations; and in fact how are we to obliterate all the arterial branches which arrive at the circumference of such tumors? Isolated ligatures clearly address themselves only to the branches of a certain volume, those whose pulsations are perceptible under the skin, or whose anatomical relations are well known. But who does not know that an infinity of minor arteries, (*artérioles*,) of the smallest calibre, and the capillaries, must necessarily exist between the principal branches; then how can we be assured that the deep-seated surface of these

tumors does not receive other arteries of sufficient size to replace those we have just obliterated?

C. *Ligature on the Principal Arterial Trunks*.—The difficulties I have pointed out, and the failures I have related, have induced practitioners to extend the ligature to the principal artery itself of the region occupied by the disease. Thus have the carotid arteries been tied for tumors of the head, the brachial and the arteries of the fore-arm for tumors of the thoracic extremity, and the femoral for those of the abdominal limb.

I. *Arteries of the Head*.—It was in 1809, that M. Travers tied the primitive carotid for an erectile tumor upon the orbit. M. Dalrymple, his countryman, did the same for a tumor very similar. The two patients recovered. Two similar operations were performed by M. Wardrop, for erectile tumors upon the face. One of the children died on the fourteenth day, in consequence of hemorrhage and suppuration; the other got well. In a third case also, M. Wardrop tied the primitive carotid, having obtained no benefit from a ligature on the temporal and frontal arteries: the patient died. An analogous operation, by M. Walther, also proved unsuccessful. The tumor was seated on the temple. In the case of M. Davidge, the patient was seized with trismus and died at the expiration of six weeks. That of M. Pattison appears to have been completely cured. In these two cases the tumor was in the cheek. M. Maunoir failed entirely in his operation; and the same occurred with M. Dalrymple in a second trial with it. The case of M. Machlachlan was one of varicose degeneration of the arteries of the hairy scalp, and the patient died. It would appear that the patient of M. McClellan, who had an erectile patch over the whole right side of the face, at least derived some advantage from the operation, if in fact the cure has not been entirely completed. An erectile tumor of the antrum highmorianum was cured in this manner by Dr. Hall. So also in a patient of M. Arndt, who had an erectile tumor on the upper eye-lid; but it is necessary to be added here, that the surgeon afterwards made a crucial incision through the tumor, that he successively (*separément*) tied twelve small arteries, (*artérioles*), that many hemorrhages still took place, and that it required four months for the cure to be completed. The man operated upon by Delpéch had an erectile tissue (*réseau*) in the nasal fossæ, and at first only appeared imperfectly cured. An erectile tumor upon the temple, which M. Williaume treated by a ligature upon the primitive carotid, did not diminish. The patient operated upon successfully by M. Busk had an erectile tumor in the orbit. That of M. Roux, in which the tumor also occupied the orbital and temporal region, was but imperfectly cured, when he was lost sight of.

If the persons operated upon by MM. Bernard, Rogers, and Busch, were cured of their erectile tumors by a ligature upon the carotid artery, we find that the operation did not succeed in the case of M. Jameson, and that it was followed by death in those of MM. Kuhl, Mayo, Zeis, Peyrogoft, and in that of mine, and

that it failed also in the patient in whom M. Mussey applied successively the ligature upon both carotids. As to the patient recently operated upon at Marseilles by M. Martin, (*Lancette Fr.*, t. XII., p. 486,) we are yet unacquainted with the benefit he will derive from a ligature upon the primitive carotid. (See the Table of Ligatures upon the Carotid, *supra*.)

It results from these details that the ligature upon the carotid artery is far from being sufficient always for the cure of erectile tumors of the head. It is to be remarked that these tumors upon the temple and external part of the head have less frequently disappeared under the influence of this operation than those of the orbit, eye-lids, nose, cheeks and sinus maxillare. The patient operated upon by Delpech, and in whom the erectile tissue occupied the septum nasi, (cloison du nez,) appears at the present time to be definitively cured; for in the notice of the case of M. Martin, it is stated that he still lives at Marseilles, in a state of perfect health.

I have mentioned that those who were cured by M. Travers, M. Dalrymple, M. Arendt, and M. Busk, had the tumor in the orbit or eye-lid; that in those of MM. Pattison, McClellan, and Hall, it was situated upon the side of the face; while in that of mine, that of M. Williaume, that of Dupuytren, that of M. Walther, that of M. Machlachlan, one of those of M. Wardrop, and some others, it was located upon the temple or cranium. If the erectile tumors only of the orbit had terminated favorably, it might be explained perhaps, by recalling to mind with MM. Roux and Hervez, that the ophthalmic artery here forms a small vascular system in some sort independent, whose functions would necessarily be interrupted by a ligature upon the carotid: but the same (successful) result having taken place upon other regions of the face, we can scarcely attach any importance to this arrangement.

However that may be, it would seem that erectile tumors upon the head, which are to be treated by a ligature on remote arteries, ought not to be so attacked without discrimination by the obliteration of the primitive carotid; for myself I should prefer that those of the chin, lower lip, and even upper lip, should be treated by a ligature upon the two external maxillary arteries, and those of the floor (plancher) of the mouth and the tongue by a simultaneous or separate ligature upon the facial and lingual arteries. For tumors on the exterior of the cranium I should tie the carotid or the two secondary carotids at the same time with the primitive carotid. If the disease occupied the nose or antrum highmorianum, I would confine myself to the ligature of the external carotid, immediately below its division into the temporal and internal maxillary arteries. Finally, in cases of erectile tumors of the orbit or eye-lids, I would tie the internal carotid alone, or the internal and primitive carotid. We have, moreover, seen in the table cited above, that these operations are sufficiently serious and sufficiently often fatal to inspire the minds of surgeons with well-grounded fears. We should therefore not decide upon them unless the disease has acquired a great development, menaces the life of the patient, or really constitutes

a deformity of a grave character. I will add, that we ought not to come to this resolution, until after having made trial of topical applications, compression, vaccination, tatooing, and cauterization, in the cases of superficial tumors; acupuncture, le broiement, multiplied setons, and irritating injections, where they are thick or deeply situated; also that we should take into consideration whether extirpation, supposing it practicable, ought not even then to have the preference to the ligature in question.

II. *In the Limbs*.—A ligature upon the principal arterial trunk appears to have been but rarely followed by success in the cases of erectile tumors. I have already said, that in tying the arteries of the fore-arm for a tumor on the fore-finger, M. Hodgson had failed completely. In a case cited by M. Chelius, (*Handbuch der Chir.*, t. I., p. 884, Heidelberg and Leipsic, 1826,) an erectile tumor upon the knee equally resisted a ligature upon the femoral artery. The same operation, performed in 1819, by Dupuytren, (Breschet, *trad. de Hodgson*, p. 26, ou *Répert. d'Anat. et de Phys.*, etc., t. II.; *Arch.*, t. XIII., p. 459,) for a vascular degeneration at the lower extremity of the femur, was no less unfortunate. Nevertheless, MM. Roux, (Tarral, *Archiv. Gén.*, t. VI., p. 26, 2e série,) Graefe, (*Gaz. Méd.*, 1835, p. 169,) and Chelius, appear to have each succeeded once in curing erectile tumors of the fore-arm or hand, by tying the neighboring artery; and M. Lallemand, (*Bull. de Férussac*, t. XV., p. 73; *Arch. Gén.*, t. XIII., p. 514,) by obliterating the crural artery, has been no less successful in a case of vascular degeneration upon the tibia. So that under this point of view, the successes and reverses are, up to the present time, in some sort balanced.

Be that as it may, erectile tumors upon the limbs, which occupy only the integuments, or sub-cutaneous tissue, seem rarely disposed to yield to the ligature upon the principal artery. The branches which penetrate directly into the tumor should be attacked by preference, whether by the circular section in one or several stages, or by the ligature, properly so called, on each small artery. As to the tumors more deeply situated, those especially which have been noticed in the tissue of the bones by Pott, Pearson, Scarpa, Rossi, Dupuytren, Roux, and Lallemand, of which I also have met with two examples, inasmuch as it could be amputation only of the limb that we could oppose to them, and that they have already been sometimes observed to recede after the ligature upon the principal arterial trunk, I am of opinion that it would be advisable to submit them to this last operation. In such cases, though the ligature upon the artery should offer but one chance of cure out of three or even out of ten cases, still it ought to be preferred. For supposing that it should not result in a cure, it would not prevent our proceeding at a later period to amputation if that should be found necessary.

What I have said further back, however, shows that we should err in reposing entire confidence in this kind of remedy, and that the erectile tumors of the bones of the limbs resist, as often at least as those of the head, the ligature on the arteries which nourish

them. We ought not, therefore, to prefer this means, except where all the others I have hitherto mentioned are impracticable. The circular section for the tegumentary tumors; the ligature of the sub-cutaneous arteries, and as near as possible to the tumor, when the fungus penetrates as far as to the fascia superficialis; the ligature to the principal trunk by the method of Ancl, where the bones or deep-seated parts (*la profondeur*) of the limb appear to be the seat of the evil; such is the order in which this kind of operation should be placed in a practical point of view.

§ XIV.—*Extirpation.*

In former times, erectile, like all other tumors, were fearlessly submitted to extirpation, but J. L. Petit, J. Bell, Callisen, Dupuytren, and MM. Wardrop, Roux, and Walther, have inspired so much apprehension in regard to the operation, that most surgeons no longer decide upon it except in cases of extreme necessity. The accident the most formidable and the most frequent of this operation, is hemorrhage. A patient died thus in some sort under the knife of M. Wardrop; the same occurred in a patient of M. Roux. The same practitioner, on another occasion, was upon the point of losing a second patient, before having terminated the operation. Two patients also of M. Hervez de Chegoïn, caused in the mind of that surgeon the greatest apprehension. M. Bushe, after having excised an erectile tumor from the temple in an infant aged thirty months, perceiving the hemorrhage recur, was obliged to resort to a ligature upon the external carotid.

Nevertheless, these dangers rarely take place, except in cases where the tumor is badly defined, (*mal limitée*), or where it is impossible to cut exclusively upon the sound tissues; and experience proves that, practised in such manner as to remove the erectile production entire, and in addition, a breadth (*cercle*) of unaltered integuments, extirpation is still the most sure and the most rational of this order of remedies. What prevents it from being proposed for all cases, is the deformity which must necessarily result from it, when the tumor occupies a very extended surface, or the depth and uncertainty of its limits, when it is situated either in the central portions of the limbs, or in the cavities of the head.

F. De Hilden, who had already perceived the importance of this operation, positively recommends that in extirpating the tumor, we should leave no vestige of it, but carefully remove all its roots. Turner (*Malad. de la Peau*, p. 234) mentions, on the authority of Willis, erectile tumors which had been extirpated without danger in his time. Warner, (*Obs. de Chir.*, p. 68,) in operating in this manner upon the forehead, had been no less fortunate. Alanson, (*Manuel de l'Amput.*, p. 199,) while extirpating from the forehead of a child of seven years of age, an erectile tumor of more than an inch in extent, caused, by way of precaution, compression to be applied all around it. We may find also in the work of M. Maunoir (*Memoire sur le Fungus Hématode*, p. 90 à 100) some examples

where extirpation of these tumors was performed with entire success. Others of the same kind will be found in the memoir of Briot, (*Progrès de la Chir. Milit.*, p. 298; et *Dict. des Sc. Méd.*, t. XVI., p. 334.) M. Champion extirpated one in a woman, aged 25 years, which was situated upon the upper and anterior part of the arm, and was of the size of a pound loaf of bread. M. Roux (Maréchal, *Révue Méd.*, 1825, p. 29) succeeded perfectly in a case where Dupuytren was not willing to venture upon any remedy. An infant, aged eighteen months, had upon the outer angle of the right eye an erectile tumor of the size, form and color of a calf's kidney, (rognon de veau.) M. Loreau, (Communicated by the author, 29th September, 1837,) having effected the extirpation of this tumor, employed the suture, in order to unite by first intention, and obtained complete success. In an infant, fifteen months old, and who, among other erectile tumors, had one of an inch and a half in diameter on the root of the forehead, between the eyebrows, the operation of extirpation which I had forbidden from fear of too deformed a cicatrix, was performed with success in 1837 by another surgeon of Paris. The facts of this kind, however, at the present day are so numerous that there is no necessity of making particular mention of them.

Extirpation in these tumors, in order that it may offer real chances of success, exacts several conditions: first, that the instrument should remove everything; secondly, that we should have it in our power to make compression with a certain degree of force, either at the bottom or on the periphery (contour) of the wound as well as upon the principal arterial trunk of the neighborhood; finally that the surrounding tissues should be free from every kind of vascular degeneration; when with these it should be possible to unite by first intention, without making traction upon the parts, we could desire nothing more; but should it become necessary to dress flat, the operation might still succeed if the other conditions which I have just pointed out, were actually present. An erectile tumor, six inches long, of the form of a calf's tongue, and which had existed from the age of seven years on the outer and upper part of the left leg of a female, and which had been unavailingly treated by compression, and transformed by this means into a vast pouch, was extirpated with complete success by M. Nève, (Communicated by the author to M. Champion,) though he was not enabled to unite by first intention.

Moreover, I should not confine myself to extirpation, as M. Ouvrard recommends, (*Obs. de Méd. et de Chir.*, p. 374-379,) for the removal of purely vascular tissue, unless cauterization, in such manner as to preserve the healthy tissues which envelop the disease, should be afterwards associated with it, as it was on one occasion successfully by M. Bedor (*Journ. Hebd. Univ.*, t. II., p. 396) for a pediculated tumor of the cranium.

In the young person whom I have spoken of in the paragraph on multiplied setons, I was desirous of preserving the skin which was sound. Having freely dissected the parts, I removed the whole

tumor, together with about an inch and a half of the radial artery which was included in it. The blood flowed abundantly; but tamponing with small balls of lint and compression sufficed to arrest it, after a ligature had been applied to the two ends of the radial artery. The wound regularly cicatrized; but as I have already said, a point on the skin, and some sub-cutaneous protuberances, (bosselures,) give me at the present moment, (January, 1839,) some fears in respect to the return of the disease. I should remark that the tumor in this case was badly defined, and that a multitude of dilated vessels were given off from it like so many rays from its circumference. M. Lallemand, (*Arch. Gén. de Méd.*, 2e série, t. VIII., p. 5,) in one case, effected a cure by extirpation, though the tumor occupied the gums, and that he was obliged, at the same time, to remove the whole breadth of the lower alveolar border. M. Nichet (*Rév. Méd.*, 1838, t. III., p. 242) was no less fortunate in a case in which he performed the operation of cheiloplasty, after having extirpated the tumor which was situated upon the lower lip and a part of the cheek. A livid, irregular, (bosselée,) hard tumor of the size of a nut, had existed for many years between two heads of the metacarpal bones on the dorsal side of the root of the medius, in a girl aged eleven years. I extirpated it without interfering with the neighboring articulation, and the cure has remained complete since the month of July, 1838. The operative manual has nothing special in such cases, except that it should be submitted to the rules of incisions in general, and exact great precautions in relation to the employment of provisional and even definitive hemostatic means.

§ XV.—*Amputation.*

The tendency of crectile tumors to repullulate, the dangers attending their extirpation, the difficulty of attacking them when they have invaded the interior (la profondeur) of the limbs, have suggested the idea of performing amputation for the cure of some of these cases. This operation, the propriety of which has been especially treated of by M. Mannoire and M. Hervez de Chégoire, is not in my opinion justifiable in any case at the outset, (de prime abord.) I should not decide upon it but in the last extremity, after having vainly essayed all the other methods, and where the disease actually compromised the life of the patient by the rapidity of its progress, or had permanently destroyed the functions themselves of the part where it was situated.

Erectile tumors of the bones only could justify recourse to it, and not then even, as I have already said, should we come to this determination, until after having fruitlessly made trial of a ligature upon the principal arterial trunk of the region. If with MM. Mannoire and Hervez we should sometimes have recourse to amputation, it would be solely in those cases where melanotic, cerebriiform or scirrhus productions have become implicated with the erectile tissue. The question, then, would be of a cancerous tumor, and no longer

one that was purely fungous; and the chances of the operation whether fortunate or unfortunate, would have to be weighed after the known nature of cancers, and not from what has been said of sanguineous tumors. The cases of a return of the disease mentioned by M. Maunoir, M. Fine, (*Journ. Gén. de Méd.*, t. XLV., p. 46,) and M. Gérard, (*Journ. Univ. Hebd.*, t. II., p. 413,) and by a multitude of others, are not sufficient to authorize us to say with M. Hervez, (*Journ. Univ. de Méd.*, t. II., p. 22,) *that the removal of accidental sanguineous fungous tumors of the limbs, has never been followed by success*, and that, therefore, amputation is preferable. The case of M. Nève and that of M. Champion, would alone suffice to refute this proposition.

ARTICLE III.—GENERAL APPRECIATION.

I have described with some detail the different kinds of operations hitherto proposed against erectile tumors, because, though there may be none of them which are suitable to all cases, there is not one of them which ought absolutely to be rejected. Erectile tumors present so much diversity in respect to their breadth, thickness, and layers, the regions they attack, and their nature and progress, that it is impossible to submit all of them to the same kind of treatment. Thus topical astringents, styptics, and refrigerants, applied to tumors that are superficial, of but little extent and still recent, are calculated to procure some successes. Compression alone, or aided by these last-named measures, if continued for a long time, will succeed in some cases wherever it is possible to apply it conveniently. Compression also, though less active and less powerful than caustics, might be made trial of with astringents in cases of sub-cutaneous, diffused and irregularly flattened tumors. However, it will always be found one of the remedies which are the least to be depended upon, and one on whose efficacy we must not deceive ourselves. Cauterization, by means of potash and ulceration, having the advantage of not alarming the patient, and of succeeding sufficiently often, should have the preference where the tumors are cutaneous, irregular, and too large to be extirpated. [This is a very favorite and successful remedy with Dr. Mott in such cases, where the red-hot needles cannot be applied, or do not succeed. His next great reliance is extirpation or excision, at a suitable distance from the periphery of the disease, so as to cut into a margin of sound tissue. T.] In cases of flat and regular tumors, it is much better to recur to cauterization *en nappe*, [vid. supra,] whether by means of a fragment of caustic potash, or with a pencil, slightly wetted with nitrate acid of mercury. If the whole thickness of the dermis should be affected, we should succeed still better by covering the whole degenerated patch, which has been previously denuded of its epiderm, with a layer of zinc paste, or the Vienna caustic; or by applying to it the red-hot iron.

Vaccination and tatooing would not be suitable, except the first, on some fungous masses imperfectly circumscribed; and the second

for *nævi* of the most superficial character and least thickness: it is even doubtful if these methods deserve to be retained in practice, under any consideration.

Nor does *broiement* (or breaking up of the tumor) appear to possess any very great value; I would not make trial of it, but for bulky (*épaisses*) tumors of a certain volume, and which it would afterwards be easy to compress. Having transformed them, by means of the needle, into a sort of sanguineous depot, I would immediately treat them by topical astringents and compression. It is in similar cases that irritating injections might be made trial of; but, as with *broiement*, they ought not to have the preference, except in regions where it might seem too dangerous to carry the cutting instrument, or in patients who have an excessive dread of bloody operations. I have said, farther back, what we may expect from the employment of setons and needles. I will add, that it would be a loss of time to attack, in this manner, flat and superficial erectile tumors, and all those, in fine, which are situated in the integuments, in the form of a layer, (*plaque*.)

Every pediculated erectile tumor may be destroyed by the ligature, in the same way as ordinary tumors; we have thereby the advantage of not exposing the patient to the risk of any hemorrhage, and of obtaining a radical cure, if the ligature is accurately placed upon sound tissues. We would not pass a needle behind the pedicle, unless the skin was so much compromised [in the degeneration] as to induce us to fear that the thread might slip upon tissues which it would be desirable to remove. Two needles, placed crosswise, would be necessary, if the tumor was flat or presented a root of some considerable size. A double ligature, passed behind and through the pedicle of the tumor, possesses the advantage of cutting through the tissues with a little more rapidity than one ligature only, placed externally, (*que la ligature pûrement extérieure,*) and also that of being more readily placed at the bottom of cavities than the ordinary ligature, or ligature under pins. In all cases the ligature is desirable, where we have great apprehensions of hemorrhage, and in young children.

The incision of the periphery of tumors cannot be of advantage but for *nævi*, properly so called, or those that are purely cutaneous; also it would be required that the skin should be almost naked on the bones, and that it is deemed of extreme importance not to deform the diseased organ. Except upon the fingers, eye-lids, nose, lips, and ears, this operation does not deserve a preference over excision, of which it possesses almost all the inconvenience, without offering its advantages. Incisions, properly so called, whether simple, as they are employed in Prussia, or associated with partial excision, as practised by MM. Ouvrard and Lallemand, would not deserve to be made trial of, except in similar cases, and even then it would be well to associate with them the employment of setons, caustics, compression, or topical applications, if the thing were practicable.

A ligature upon the arteries of the fungus itself will never be

proper, unless we should see them pulsate under the skin, and that they were well isolated, or the tumor too large and too thick to be attacked by cauterization or extirpation. Before deciding upon this, we should have made trial of most of the methods which I have just described. It is only, moreover, upon the cranium and face that it would be advantageous to proceed in this manner. As to the ligature upon the principal arterial trunks, as it is of itself a serious operation and fails in one case out of three, it should never be thought of, when the tumor occupies only the dermis or the sub-cutaneous layer, unless it is one of a very large size, and which has already resisted all other means. We should reserve it, then, for those erectile tumors which it is not practicable to attack with security either by caustics or cutting instruments, or for those of the cavities of the cranium and face, for example, and those of the osseous tissues and interior of the limbs.

As to extirpation, though it be in reality the *best method of all*, when the tumors are well defined, cutaneous or sub-cutaneous, we should not, however, propose it to persons who dread it; above all, not until after having in vain made trial of one of the others; but we should come to it at first, if there are no personal objections opposed to it, and in all cases where we would be enabled to unite the wound by first intention, and in all regions where a large cicatrix can have nothing about it of a revolting character, (*d'effrayant*.) We should also, moreover, decide upon it when the other methods have failed, especially when it may be in our power to guard against the hemorrhage to which it may give rise, and in all those cases where there is no choice left but this and amputation, properly so called. I have no necessity of recurring to the limitations which I have assigned above to this last resource.

[ERECTILE TUMORS.

Treatment of Erectile Tumors, particularly Nævi Materni.—Though we have taken occasion in the first volume of this work, to enforce the necessity of adopting in every case where it may be possible, the method now generally *practised in this country*, by Dr. Mott and others, of treating those congenital meshes of aneurismal vessels, (chiefly venous in most cases undoubtedly,) in infants and children, which are known more generally as *nævi materni*, sometimes as *aneurism by anastomosis*, and in France, (as improperly designated by Dupuytren,) *erectile tumors*, (see Vol. I.) we must again allude to it here, which is perhaps, its most appropriate head.

It has often been justly remarked, and the same observation, is, as we perceive in the discussions in the Academies at Paris, coming more into repute every day, that the apparent rudeness, boldness, and severity of the practice of *veterinary surgeons*, who in Europe are educated men, and of scientific attainments and respectable rank, and who have no responsibilities or interferences to contend with, except the single aim and end of effecting a cure of their patients, has been of itself the providential means of paving the way

for some of the most daring and brilliant operations in human surgery. Take the section of the tendo Achillis, and the use of the hot iron as examples, (see Vol. I ;) to the latter of which remedies, surgery, as regards the human species, has also at last, step by step arrived in the treatment of the disease in question, one of the most common, and also unfortunately one of the most formidable, at least in its deformity, of all the *opprobria medicorum*.

From immemorial time deemed among the number of those congenital misfortunes or blotches, which were beyond the reach of surgical art, no serious effort was scarcely ever undertaken for their removal. Finally, without pretending to add anything to the erudition of their early history as given by the learned author of this work, M. Velpeau, we shall proceed at once to say, that all therapeutic means, surgical or medical, have it may be alleged, proved in too many instances utterly impotent, or what is worse, sources of aggravation to the existing malady.

Thus, to say nothing of the occasionally radical cure by extirpation, the most ingenious and efficacious of all methods up to the time of the method by *perforation with red hot needles*, or the *American process*, as it may be emphatically called, was undoubtedly that of M. A. Bérard, or that of the application of the *Vienna Paste*, or *Caustic*, as modified by him, and which undoubtedly owed also all its value to its severity and boldness. M. Bérard, (*Mém. sur le Traitement des Tumeurs Erectiles*; par M. A. Bérard, Membre de l'Académie de Médecine, Paris; Chirurgien de l'Hôpital de Necker—in the *Journal des Connaissances Medico-Chirurgicales*, Paris, December, 1841, p. 249, et seq.) employs the Vienna Powder which is composed of lime and caustic potash, according to the mode of preparing the same in the *Codex*, by making it into a soft homogeneous paste, by mixing it gradually with a little rectified alcohol, and then spreading it in a thin layer over all the tumor, except within a few lines of its circumference, that marginal portion of the *nævus* being sufficiently impregnated with it by means of the imbibition of the solution of the potash in the alcohol. The paste is to be completely washed off in the space of from five to ten minutes.

But although this surgeon at the time of publishing this memoir, gave this mode a decided preference over all others, and had used it, he says, with great advantage in more than thirty cases, yet it is clear from his description that there is much danger from it, by the copious hemorrhages it may produce, and also the necessity of one or more re-applications of it on account of its not executing its office effectually, or from the liability of a return of the disease.

The process of M. Lallemand of Montpellier, was undoubtedly nearer the mark in its inception, so far as the real mode of cure, was in some measure shadowed out by him in this first step. He, in fact, following out M. Velpeau's process for varicose veins, and perhaps also M. Velpeau's suggestion of the *hot iron* to *nævi*, (see text above,) inserted in various directions, and repeatedly through the tumor, pins, which were left there until suppuration was effected

through their track. M. Bérard objects that they did not in his own hands prove sufficiently exciting, on which account he substituted *ivory pins*, which one, *a priori* would say, were much less so than the metallic bodies; and to effect his object more completely he superadded the complication of a *platina syphon*, with a glass canula attached, in order to inject in the tracks of the ivory pins, the *nitric acid of mercury*. But the inflammation and suppuration here again proved too violent, besides causing subsequent indurated growths, on the part, and endangering the whole constitution, if not life, by the imbibition of so dangerous a poison as the fluid used for injection. Finally, M. A. Bérard abandoning all other modes, adopted that which (as will be seen in the text above,) had long before been made trial of, to wit: *numerous setons*, by means of which he strangulates the tumor, and had up to the time he wrote, thereby succeeded in every case in which he had tried it.

To all these must now give place in the generality of *næval tumors*, and when not too deeply involving the subjacent tissues, the process most in repute in this country, or the *American method*, which as we have stated, (Vol. I.,) we will now repeat, consists in the rapid and successive application of slender, delicate steel pins of from two to three, and four inches in length, furnished with firm, short, small wooden handles, and kept near by, heated to a red heat in a small chafing dish of coals.

The pins are inserted one after the other transversely and horizontally, and as near the union of the base of the tumor to the skin, or sub-cutaneous and dermoid tissue as possible. They literally *burn their way through*, and at the same moment *roast an eschar* in their passage, which becomes the new wall to the track they have made. As soon as one pin is inserted, it is immediately withdrawn. This is followed by a second, and so on, going close to the track of the preceding, until the whole diseased mass, and congeries of vascular canals is actually riddled, broken up and converted into one eschar as well as isolated from the healthy parts underneath by one continuous layer of the same. A healthy, and most salutary action, just enough to accomplish the object in view, and no more, is thus set up within, and at the base of the tumor, while the latter is transformed immediately into a superincumbent incrustation, that becomes detached as soon as the new reproductive granulating process underneath has completed the cure. Very little, or no suppuration, and never any bleeding ensues. In fact a better hemostatic means could not be devised than the operation itself, which thus finishes up as it goes, every thing required, producing very little pain, and that momentary, and leaving no subsequent steps to be taken by the surgeon himself, scarcely even a common dressing. Adroitness however, is required in the proper application of these red hot needles, and the operation has sometimes to be repeated.

Dr. M. Hall proposed, as early as in 1831, (*Lond. Med.-Chirurg. Rev.*, April, 1831; *New York Medical Journ.*, Vol. II., No. 1, p. 184,) to cure *nævi* by introducing *horizontally* and eight or ten times

through the tumor near its base on or in the skin a *couching* needle with *cutting* edges. He thus cured one over the size of a shilling. This process required only the *red heat* to the needles to give it the perfection it now has. Mr. Liston, (Cormack's *Journ.*, Oct., 1843, p. 943; *London Lancet*, April, 1st, 1843, p. 27,) in 1843 removed an erectile tumor from the popliteal space in a boy, aged 10 years, which had existed there from the age of 2 years. It was situated deep, and was completely covered with the fibres of the semi-membranosus muscle, which was the cause, no doubt, of its presenting such obscure diagnostic marks to the touch, being represented as doughy, fluctuating, solid, elastic, fatty, &c. A seton had been passed through it, and a discharge established without any benefit. It was moveable and distinct from the bone: when cut into during the operation much blood was discharged from it, and also much in its neighborhood. On the 16th day the boy was perfectly well. The tumor, Mr. Liston says, microscopically examined, was found to be of perfect erectile tissue. Mr. Liston considers it to have been developed in the muscles with which it was connected, and instances a tumor of different structure which he removed from the side of the neck, and which he believes to have originated in the interior of the sterno-cleido-mastoid muscle, in which last case there was great hemorrhage.

Amorphous Erectile Tumor removed by Dr. Mott.—In June, 1845, at New York, Dr. Mott removed a tumor of the size of a turkey's egg upon the left side of the neck of a young man, aged about 25, of spare make and pale complexion, temperate habits, and otherwise healthy, which tumor was completely covered by the attenuated expanded fibres of the sterno-cleido-mastoid and omo-hyoideus muscles, and in its lower part complicated with the thyroid body and vessels. It lay obliquely on the inner margin of the normal line of the first mentioned muscle, which, however, in consequence of the growth of the tumor, had undergone in this part the distension, attenuation, and lateral expansion mentioned. In dissecting down upon the tumor, which was of the shape of a long oval, it was found, underneath its muscular parietes, to be covered with a series of pellucid or thin transparent dense membranes, like the fasciæ of femoral hernia, two or three in number, on the division of which a formidable hemorrhage ensued from the enlarged superior thyroid arteries and veins which traversed its substance, and which was found to be of an amorphous character, partly erectile and partly of thickened semi-cartilaginous and hydatid encysted tissues. In this operation the infra-maxillary artery, which also sent off branches to the upper part of the tumor, was accidentally divided, the upper end of which, during a movement of deglutition or turning of the neck, receded an inch or more upward, above and within the base of the jaw, and was not secured until after a number of unsuccessful attempts with the tenaculum and forceps. This circumstance occasioned considerable embarrassment from the large column of blood which issued from the abnormally enlarged calibre of the vessel; and had Dr. Mott not

succeeded in securing it in time, it was his intention to have passed a ligature upon the common carotid, the sheath of which had been laid bare by the operation. To avoid the danger of farther hemorrhage, a ligature was passed around the root of the tumor and its adjacent connections, by which means indirect compression was thus established upon all the included vessels. About an inch of the diseased parts was thus left in the wound, together with the ends of some dozen or more ligatures which it had been found necessary to apply during the operation.

The diseased tissues included in the general ligature sloughed away completely, and the parts healed up kindly, effecting a perfect cure. [Extract from a memorandum of this operation by P. S. Townsend.]

M. A. Bérard (see Malgaigne's *Méd. Opérat.*, 4th edit., Paris, 1843, p. 118,) makes three classes of *erectile tumors*, which, though we cannot at all sanction, may be mentioned, to place the student on his guard against the confusion which exists among modern writers on the nomenclature of these diseases. M. A. Bérard's classification is: 1st, where the lesion is in the capillary veins of the skin; 2d, in the sub-cutaneous veins; and 3d, in the arterial branches. It is difficult to say under which head he comprises the familiarly known congenital cake-like forms of cutaneous *nævi materni* of infants; for these meshes of vessels seem to comprehend all the localities, tissues, and organs named; more especially the veins, and the majority of these are by no means *capillary*, if their great dilatation is to be taken into the account.

From a remark of M. Malgaigne, (*Op. cit.*, p. 122,) it would appear that he considers the dilated vessels in *nævi* to be arterial; and hence, probably, from this idea the name given to them by some authors, of *aneurisms by anastomosis*.

M. Ollivier proposes here, too, inoculation with *hospital gangrene*, and that on infants! (*Ib.*, 123.) The ligature on the neighboring arterial trunk which supplies the part, as the carotid for example, is equally useless, as we have noted in most cases.

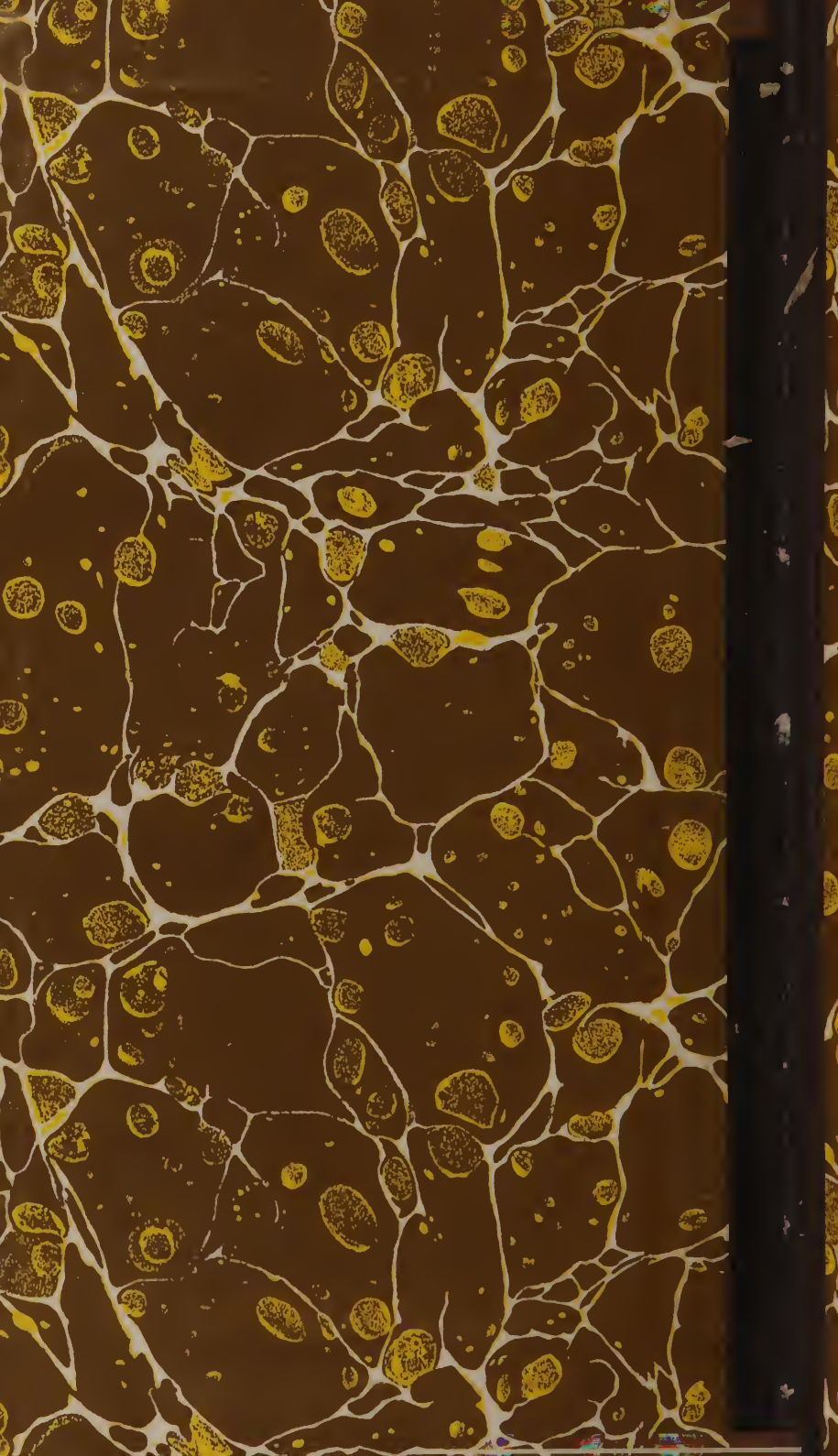
M. Lafargue, however, (Sitting of the Academy of Sciences, Paris, Jan. 29, 1844; *Archiv. Gén. de Méd.*, Février, 1844, p. 237,) recommends, for the cure of congenital erectile tumors known under the various names of *nævi materni*, *envies*, &c., the making of five or six punctures around the tumor, by means of a lancet whose point has previously been dipped in the oil of *Croton Tiglium*. An ulceration is thus produced, which, after healing, leaves a cicatrix so much the less prominent in proportion as the child is younger or the tumor more circumscribed.

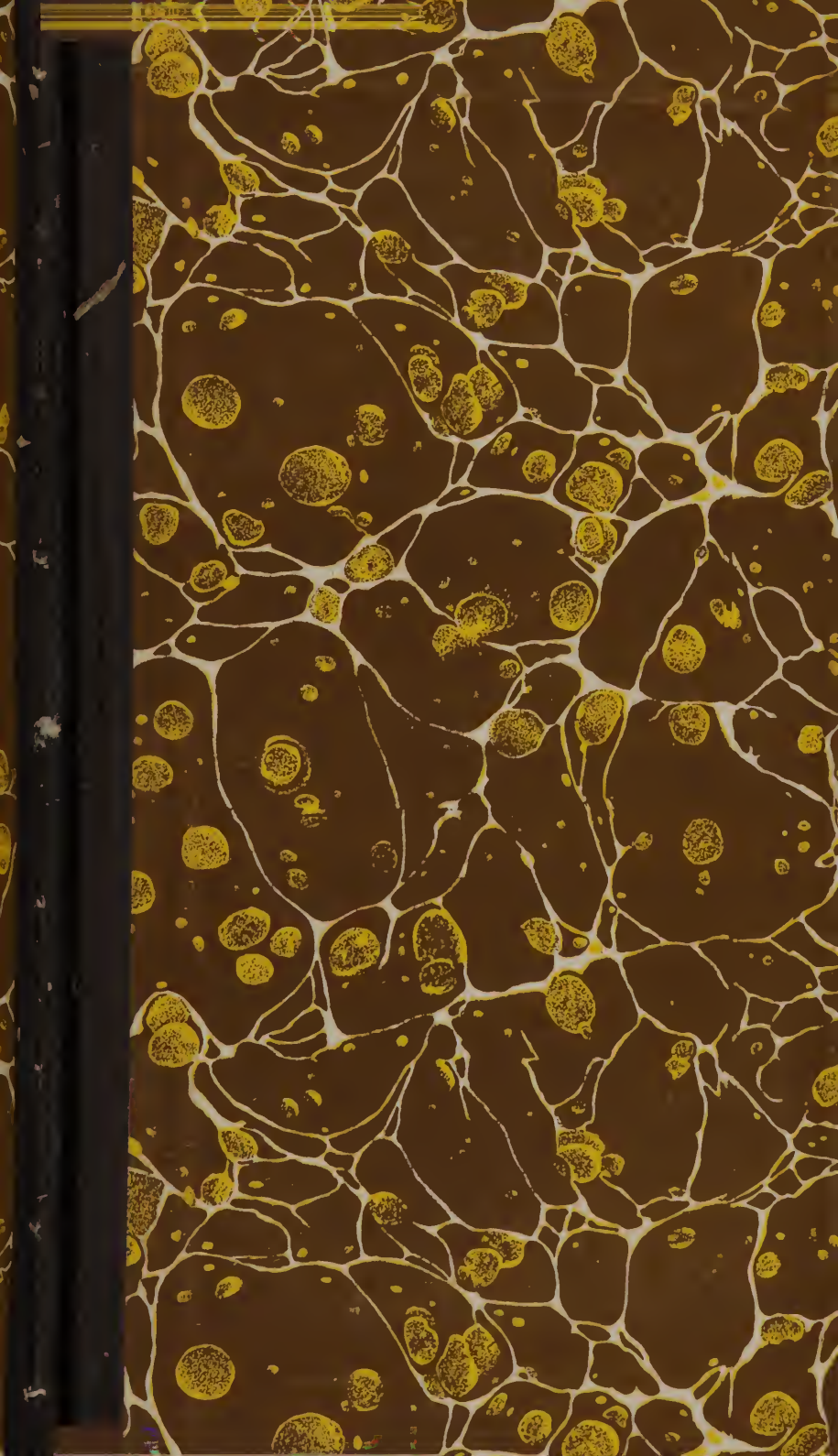
We doubt very much whether the use of so dangerous a substance as Croton oil should be substituted for the more prompt and less formidable and efficient methods of cure.

Singular Erectile Tumors of the Toes and Fingers.—M. A. Bouchacourt (*Journ. des Connaiss.*, &c., Paris, March 1, 1844, p. 113, &c.) has met with small painful tumors, of a vascular texture, and apparently erectile, in the thickness of the skin and toes, near the

nail. They appear to have their seat in the horny lamella of the papillæ, and their distinctive character is the union of a great quantity of vessels, which bleed profusely in extirpating them. Their hardness contradistinguishes them widely from ordinary erectile tumors. In the course of their development, they may become the seat of an osseous formation analogous to exostosis; but they, nevertheless, preserve their primitive structure. He effected, in two cases, a radical cure by *excision* and free cauterization, especially with the Vienna paste, which in one case answered, where nitric acid of mercury seemed to be insufficient. T.]

END OF VOL. II.





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